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ABSTRACT

The following papers are included: "Focusing Agricultural Education Research" (Williams); "A Time Series Analysis of Agricultural Education Student Teachers' Perceptions of Agricultural Mechanics Laboratory Management Competencies" (Schumacher, Johnson); "Determination of the Agricultural Mechanics Laboratory Management Inservice Needs of Missouri Agriculture Teachers" (Johnson, Schumacher, Stewart); "Factors Influencing Secondary Michigan Agricultural Students about Non-Membership in the FFA" (Connors, Moore, Elliot); "Vocational-Technical Faculty Efficacy" (Dean, Adams); "The Association between Cooperating Teacher and Teacher Educator Evaluations of Student Teaching Performance" (Baker, Hedges); "Morale Levels of First-Year Agricultural Education Teachers" (Henderson, Nieto); "An Assessment of the Level of Cognitive Performance and Critical Thinking Ability of Selected Vocational Agriculture Students" (Cano, Martinez); "The Relationship between Critical Thinking Ability and Level of Cognitive Performance of Selected Vocational Agriculture Students" (Cano, Martinez); "Mathematical Problem Solving Competence and Related Factors of High School Vocational Agriculture Teachers and Students" (Persinger, Gliem); "The Relationship between the Professional Education Component of the Agricultural Education Curriculum and Graduate Career Choice" (Baker, Hedges); "Cognitive Levels of Instruction and Student Performance in Selected College of Agriculture Courses" (Miller, Newcomb); "The Impact of Increased Admission Requirements on Students' Academic Credentials upon Entry to a College of Agriculture" (Raven, Warmbrod); "A National Survey of Two-Year Postsecondary Institutions to Determine Selected Agriculture Program Characteristics" (Migler, Warner, Peterson); "Farmer Perceptions of Soil and Water Conservation Issues: Implications to Agricultural & Extension Education" (Martin, Bruening); "Agricultural Employment in the Illinois Food and Fiber System" (Pepple, Valdes, Law); "Curriculum and Career Maturity" (Jyung, Miller); "Educational Technology in Secondary Agriculture Programs" (Birkenholz, Stewart); "The Perceived Value of Computer Use in Secondary Agriculture Programs" (Zidon, Miller); "Institutional Factors Associated with the Level of Participation in Adult Agricultural Education Programs" (Christmas); and "Gender Based Perceptions towards Female Teachers of Agriculture" (Cano). Critiques of the papers are included. (KC)

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Proceedings of the
CENTRAL REGION
44th
ANNUAL RESEARCH CONFERENCE in AGRICULTURAL EDUCATION

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ACKNOWLEDGMENTS

Planning for the Central States 44th Annual Research Conference in Agricultural Education was aided by the advice of Dr. Janet Henderson, The Ohio State University. The information and advice from Dr. Henderson was very valuable in preparation for the 1990 conference.

Forty-six paper proposals were submitted for review. The paper proposals were reviewed by a panel of teacher educators outside the Central Region. The reviewers were:

Dr. Larry Arrington
Agricultural and Extension Education
University of Florida

Dr. Joseph Cvancara
Professor, Agricultural Education
Washington State University

Dr. Carla Kirts
Agricultural and Land Resources Mgt.
University of Alaska

Dr. Alvin Larke
Agricultural Education
Texas A & M University

Dr. Jasper Lee
Agricultural and Extension Education
Mississippi State University

Dr. Glen Shinn
Agricultural Education
Clemson University

Dr. Gary Straquadine
Agricultural Education
Utah State University

Dr. William Thuemmel
Agricultural Education
University of Massachusetts

A special thanks to Drs. Arrington, Cvancara, Kirts, Larke, Lee, Shinn, Straquadine, and Thuemmel whose review of the paper proposals provided the basis for the selection of the papers identified for presentation. Eighteen of the 46 paper proposals were selected for a 39% acceptance rate. The 19th and 20th paper proposals were identified as alternate papers. It should be noted that several of the other paper proposals were rated acceptable by the reviewers.

A special thanks is extended to the keynote speaker, Dr. David Williams, Professor, Iowa State University.

Also a special thanks to colleagues Dr. John Parmley and Dr. Richard Welton for their assistance and support this year.

Appreciation is extended to the presenters, reactors, and chairpersons; their efforts were greatly appreciated.

Appreciation is also extended to the graduate students from the University of Missouri for their help with registration.

Steven R. Harbstreit, Chairperson
Central States 44th Annual Research Conference
in Agricultural Education

PROGRAM

44TH ANNUAL CENTRAL STATES RESEARCH CONFERENCE IN AGRICULTURAL EDUCATION

Days Inn, Lake Shore Drive
Chicago, Illinois
February 24-25, 1990

Conference Chairperson: Steven R. Harbstreit
Kansas State University

Saturday, February 24, 1990

5:30 - 6:30 p.m.	Check In for Pre-Registrants and Late Registration Ontario/Erie (Lobby)

FIRST SESSION

Ontario/Erie (Lobby)

6:30 - 6:45 p.m.	Conference Overview Steve Harbstreit, Kansas State University
6:45 - 7:45 p.m.	Introduction of Keynote Speaker John Parmley, Kansas State University
	Keynote Address
	David Williams, Professor Iowa State University Topic: Focusing Agricultural Education Research: Strategies for the Discipline
7:45 - 8:00 p.m.	Question and Answer Session
8:00 - 8:05 p.m.	Announcements
8:05 p.m.	Adjourn

Sunday, February 25, 1990

7:30 - 8:00 a.m.	Late Registration - Hallway (19th Floor)

SECOND SESSION

CONCURRENT SESSION A

Michigan (19th Floor) 8:00 - 9:40 a.m.

Chairperson:	John Thompson, University of Wisconsin-Madison
Reactor:	Jerry Peters, Purdue University
Facilitator:	Judy Ellenburg, Purdue University
Topic I:	A Time Series Analysis of Agricultural Education Student Teachers' Perceptions of Agricultural Mechanics Laboratory Management Competencies Leon G. Schumacher, North Dakota State University Donald M. Johnson, Mississippi State University
Topic II:	Determination of the Agricultural Mechanics Laboratory Management Inservice Needs of Missouri Agriculture Teachers Donald M. Johnson, Mississippi State University Leon G. Schumacher, North Dakota State University Bob R. Stewart, University of Missouri-Columbia
Topic III:	Factors Influencing Secondary Michigan Agricultural Students About Non-Membership in the FFA James Connors, Michigan State University

CONCURRENT SESSION B

Superior (19th Floor) 8:00 - 9:40 a.m.

Chairperson:	Roy Dillon, University of Nebraska
Reactor:	Richard Linhardt, University of Missouri-Columbia
Facilitator:	Clark Harris, University of Missouri-Columbia
Topic I:	Vocational-Technical Faculty Efficacy: Its Relationships and Implications George D. Dean and Dewey A. Adams The Ohio State University
Topic II:	The Association Between Cooperating Teacher and Teacher Educator Evaluations of Student Teacher Performance Matt Baker and Lowell Hedges The Ohio State University
Topic III:	Morale Levels of First-Year Agricultural Education Teachers Janet L. Henderson and Ruben Nieto The Ohio State University

CONCURRENT SESSION C

Huron (19th Floor) 8:00 - 9:40 a.m.

Chairperson: Alan Kahler, Iowa State University

Reactor: Edward Osborne, University of Illinois

Facilitator: Marty Frick, Iowa State University

Topic I: An Assessment of the Level of Cognitive Performance and Critical Thinking Ability of Selected Vocational Agriculture Students

Jamie Cano and Cathy Martinez
The Ohio State University

Topic II: The Relationship Between Critical Thinking Ability and Level of Cognitive Performance of Selected Vocational Agriculture Students

Jamie Cano and Cathy Martinez
The Ohio State University

Topic III: Mathematical Problem Solving Competence and Related Factors of High School Vocational Agriculture Teachers and Students

Kevin M. Persinger and Joe A. Gliem
The Ohio State University

Break: 9:40 - 9:55 a.m. - Superior (19th Floor)

THIRD SESSION

CONCURRENT SESSION D

Michigan (19th Floor) 9:55 - 11:30 a.m.

Chairperson: Julia Gamon, Iowa State University

Reactor: George Wardlow, University of Minnesota

Facilitator: Gary Maricle, University of Missouri-Columbia

Topic I: The Relationship Between the Professional Education Component of the Agricultural Education Curriculum and Graduate Career Choice

Matt Baker and Lowell Hedges
The Ohio State University

Topic II: Cognitive Levels of Instruction and Student Performance in Selected College of Agriculture Courses

Charles Miller and L. H. Newcomb
The Ohio State University

Topic III: The Impact of Increased Admission Requirements on Students' Academic Credentials Upon Entry to a College of Agriculture

Matt R. Raven and J. Robert Warmbrod
The Ohio State University

CONCURRENT SESSION E

Superior (19th Floor) 9:55 - 11:30 a.m.

Chairperson: John Parmley, Kansas State University

Reactor: James Horner, University of Nebraska

Facilitator: Jonathan Ramathoka, Kansas State University

Topic I: A National Survey of Two-Year Postsecondary Institutions to Determine Selected Agriculture Program Characteristics

Jerome Migler, Jim Warner, and Roland Peterson
University of Minnesota

Topic II: Farmer Perceptions of Soil and Water Conservation Issues: Implications to Agricultural and Extension Education

Thomas H. Bruening and Robert A. Martin
Iowa State University

Topic III: Agricultural Employment in the Illinois Food and Fiber System

Jerry D. Pepple, Constanza M. Valdes, and Dale A. Law
University of Illinois

CONCURRENT SESSION F

Huron (19th Floor) 9:55 - 11:30 a.m.

Chairperson: Earl Russell, University of Illinois

Reactor: Eddie Moore, Michigan State University

Facilitator: Edward Williams, Michigan State University

Topic I: Curriculum and Career Maturity

Chyul-Young Jyung and Larry E. Miller
The Ohio State University

Topic II: Educational Technology in Secondary Agriculture Programs

Robert J. Birkenholz and Bob R. Stewart
University of Missouri-Columbia

Topic III: The Perceived Value of Computer Use in Secondary Agriculture Programs: A National Study

Mark Zidon and W. Wade Miller
Iowa State University

ALTERNATE PAPERS

Institutional Factors Associated with the Level of Participation in Adult Agricultural Education Programs

Oren L. Christmas, The Ohio State University

Gender Based Perceptions Toward Female Teachers of Agriculture

Jamie Cano, The Ohio State University

FOURTH SESSION

CENTRAL STATES AG ED RESEARCH CONFERENCE EVALUATION

11:30 Chairpersons of Concurrent Sessions D, E and F distribute and collect Conference Evaluation Forms at the conclusion of the session.

SCHEDULE OF RESPONSIBILITY FOR FUTURE CENTRAL STATES AGRICULTURAL EDUCATION RESEARCH CONFERENCES

1991	Iowa
1992	Wisconsing
1993	Missouri
1994	North Dakota
1995	Nebraska
1996	Minnesota
1997	Indiana
1998	South Dakota
1999	Michigan
2000	Illinois
2001	Ohio

FOCUSING AGRICULTURAL EDUCATION RESEARCH: STRATEGIES FOR THE DISCIPLINE*

David L. Williams
Professor and Head
Department of Agricultural Education and Studies
Iowa State University

Agricultural education has made a major contribution to the development of the agricultural and educational systems in the United States of America (U.S.A.) and other countries. It is hard for the people deeply involved in the discipline to appraise the impact. Also, we sometimes fail to see the future potential of agricultural education.

It is great when students and visitors from other countries ask questions about the success of agricultural education in the U.S.A. Likewise, it is rewarding when people from other disciplines ask for agricultural education expertise with a new initiative. These people see the contributions agricultural education has made and/or can make in agricultural and educational development. Agricultural education is an important discipline that has not reached its full potential. As scientists, we are responsible for the development of our discipline.

This discussion is on focusing agricultural education research. I have three objectives: (1) to analyze the dimensions of agricultural education, (2) to summarize critiques of agricultural education research, and (3) to suggest strategies for focusing agricultural education research. To accomplish these objectives, I will be building on the works of others in the discipline.

THE DIMENSIONS OF AGRICULTURAL EDUCATION

Discipline

Barrick (1988), in The Discipline Called Agricultural Education, described the unique mission of agricultural education. He defined agricultural education as "the scientific study of the principles and methods of teaching and learning as they pertain to agriculture" (p.5). Barrick (1988) made the following observations about the discipline of agricultural education and its evolution:

- Agricultural education is rooted in agriculture and education
- Agriculture grew out of the biological sciences
- Education applies psychological and sociological theories

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* A paper presented as the keynote address at the Central States Agricultural Education Research Conference, Chicago, Illinois, February 24, 1990.

Processes

The NCA-24 Committee (1987, p. 3) defined agricultural education as "the processes of education applied to the body of knowledge generally defined as agriculture". The Committee further stated that agricultural education

> includes such subjects as: needs assessment, formal and informal teaching approaches, curriculum and program development, instructional and program delivery approaches, application of educational technology, program and instructional evaluation, appropriateness of education, policy issues related to education in agriculture, institutional organization, and management of agricultural institutions in domestic and international settings (p. 3).

Buriak and Shinn (1989) grouped all agricultural education research activities into four research problem areas and described them as follows:.

> (1) Knowledge Base for Learning and Teaching . . . . addresses the theoretical-conceptual framework for learning and teaching" (p. 1) . . . . (2) Curricula/Program Planning . . . . addresses curricula and its relationship to presage, context, process, and product variables (p. 7) . . . . (3) Delivery Methodologies . . . . concerned with the linkages between the sender and receiver, and the techniques and technologies facilitating these linkages (p. 11) . . . . (4) Program Relevance and Effectiveness . . . . addresses the match between intent and outcome while measuring the validity and reliability of the process, as well as the knowledge, values, and skills of the teacher/agent and client (p. 15) . . . .

Thus, the processes used in agricultural education to apply teaching and learning as they pertain to agriculture can be generally named: (1) curriculum planning, (2) delivery methodologies, and (3) program evaluation.

Settings

Barrick (1988) advocated that the "methods and principles of teaching and learning are the same; only the application settings differ" (pp. 7-8). The NCA-24 committee (1987, p. 3) identified the following settings for agricultural education:

> (1) Formal programs offered by K-12 schools, post-secondary schools, and colleges and universities . . . . (2) Informal programs offered by extension services and other agencies and organizations . . . . (3) Educational short courses, individual consultations, written and audio-visual materials created and presented by both public and private

businesses and agencies, and agricultural programs provided by television, radio, newspapers, magazines and computer services.

We must fully understand the dimensions of agricultural education (Figure 1) before we can successfully focus our research. The domestic and international settings for agricultural education can be depicted as an arch. The keystone of the arch is the university where most agricultural education research is designed and directed that may impact all settings. Other application settings for agricultural education include schools, extension, industry and agencies. (Perhaps there are other settings, e.g. military, space, correctional institutions.) The arch rests on two vital bases - - the processes of agricultural education (curriculum planning, delivery methodologies and program evaluation), and the discipline of agricultural education (teaching and learning as they pertain to agriculture). Agriculture and education form the foundation for agricultural education with footings of biological and physical sciences, psychology and sociology.

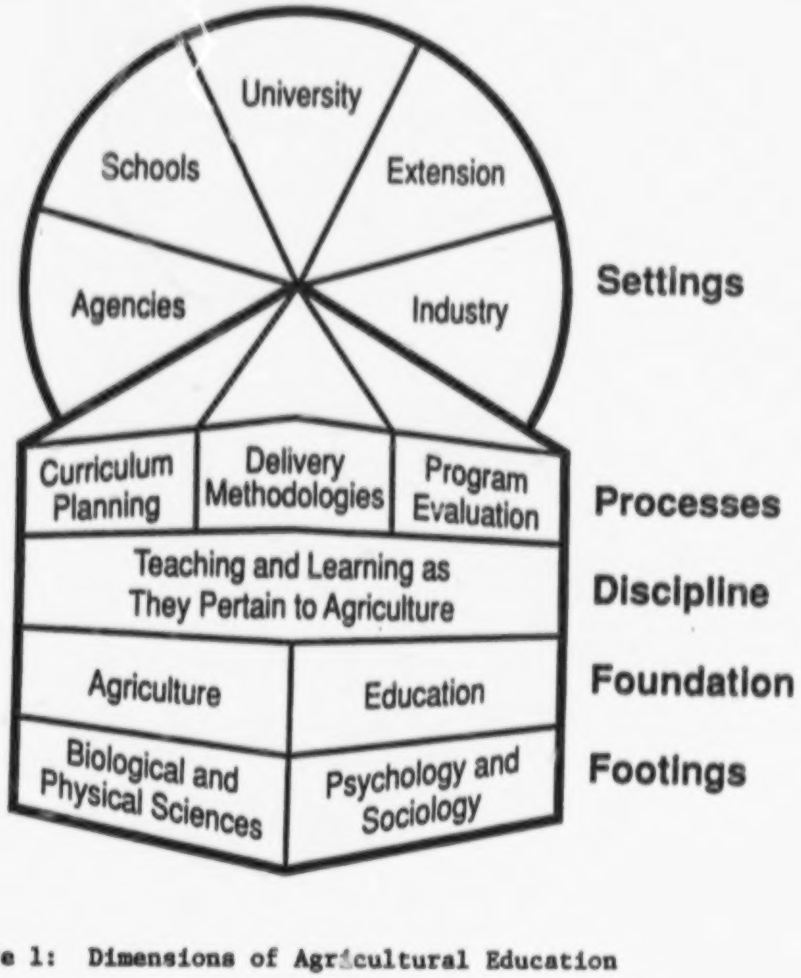
University
Schools
Extension
Agencies
Industry
Settings
Curriculum Planning
Delivery Methodologies
Program Evaluation
Processes
Teaching and Learning as They Pertain to Agriculture
Discipline
Agriculture
Education
Foundation
Biological and Physical Sciences
Psychology and Sociology
Footings

Figure 1: Dimensions of Agricultural Education

CRITIQUES OF AGRICULTURAL EDUCATION RESEARCH

We all appreciate sharply focused photographs. The same is true with research. If agricultural education research is not focused, the discipline will also lack focus.

A discipline will be no stronger than its means for verifying existing and creating new knowledge, and the dissemination and application of that knowledge. Research must be the strongest component of a discipline, serving as a foundation for teaching and extension.

Most university agricultural education units in the U.S.A. resulted from the Smith-Hughes Act of 1917, for the purpose of teacher training. This narrow focus has created some problems for the development of agricultural education as a discipline. The NCA-24 Committee (1987) advocated that the role of university agricultural education programs should include "research activities to add to the body of literature on processes of education applied to agriculture" (p. 3).

Agricultural education can take pride in several research accomplishments. The Journal of Agricultural Education has matured as a research publication. Regional research meetings and the annual national agricultural education research meeting have become effective forums for reporting research. A review of the agricultural education research reported and published reveals significant improvements in research methodology. However, we can not say the same about the focus of agricultural education research. McCracken (1982) stated that "agricultural education is a profession in which . . . . research has not been well-coordinated" (p. 33). In this regard, Warmbrod (1986) advocated that:

> ...progress during the past years in the technological and methodological aspects of research has not been accompanied by comparable improvements in another very important aspect of research, namely the relevance, significance and importance of problems and issues that we investigate (p. 9).

Authors (Warmbrod and Phipps, 1986; Carpenter and Rogers, 1970; Newcomb, 1978; Lee, 1985) of the reviews and synthesis of research in agricultural education have also filed a "lack of focus" indictment against agricultural education research. Specific weaknesses they identified included the following:

-- mostly descriptive
-- limited to identification of desirable practices
-- limited dissemination and implementation of findings
-- piecemeal
-- rarely cumulative

-- lacks a sound theoretical framework
-- mostly conducted by graduate students
-- lacks depth

Many of these weaknesses stem from lack of research focus. Buriak and Shinn (1989) reinforced this indictment when they found that 100% of the Directors of Experiment Stations, 78% of the Directors of Resident Instruction, and 64% of the Deans of Education believe that research in agricultural education lacks focus.

STRATEGIES FOR FOCUSING AGRICULTURAL EDUCATION RESEARCH

The term "strategy" is a strong term. It refers to combining and employing means on a broad scale for gaining advantage in war. Perhaps this term is appropriate, considering that agricultural education is (as are some other disciplines) experiencing some self-defeating tactics. A number of these tactics are related to the substance of our research, and is commonly referred to as "lack of focus". Since a discipline is commonly viewed through its research, we can understand why some say that the discipline of agricultural education lacks focus.

Considering the points made earlier in this discussion, I believe the following strategies for focusing agricultural education research are worthy of consideration:

1. Compare national agriculture goals with dimensions of agricultural education.

The Joint Council on Food and Agricultural Sciences has identified the following 12 priorities (listed in rank order) for agriculture for FY 1991 (Joint Council on Food and Agricultural Sciences, 1989):

- improve water quality and quantity
- expand biotechnology and its application
- develop agricultural production systems compatible with the environment
- nurture the nation's talent base in the food and agricultural sciences
- improve understanding of diet, human nutrition, and health relationships
- enhance competitiveness of U.S. agriculture
- genetically improve economically important plants
- improve safety and quality of food products
- investigate potential effects of global climate changes on agriculture and forest productivity
- enhance control of agricultural and forest pests and diseases
- develop new and expanded uses for agricultural and forest products
- enhance rural economic development

Agricultural education research can help with several or all of these priorities. Several questions can be asked to help focus agricultural education research on these priorities: (1) Can agricultural education make the best contribution at this time through curriculum planning, delivery methodologies or program planning? Which application setting should be targeted - - university, schools, extension, industry or agencies? Metrices can be constructed to compare agricultural priorities with agricultural education processes and application settings, providing useful tools for focusing research.

2. Match agricultural education research with agricultural centers of excellence.

Agricultural centers of excellence are yielding new technologies, and agricultural education can assist with technology transfer activities. Examples of agricultural centers of excellence emerging on university campuses include:

-- sustainable agriculture
-- water resources
-- food quality and safety
-- meat exports
-- rural development
-- agricultural products processing
-- biotechnology
-- economic development
-- soil tilth
-- integrated pest management, and
-- aquaculture.

3. Form partnerships with agencies and industry.

Identification of objectives that agricultural education has in common with industry and/or agencies can expand resources and help focus research. Partnerships can also facilitate dissemination and implementation of research findings. Partnerships with state and federal education agencies have served agricultural education research well in the past; however, we should be more aggressive in forming partnerships with industry and such agencies as the United States Department of Agriculture, the United States Soil Conservation Service, state departments of natural resources, the Farm Bureau and state and national commodity organizations.

4. Tie agricultural education research to educational centers of excellence.

Agricultural education can support and extend the work of educational centers of excellence through the application of teaching and learning to agriculture. Examples of education centers where agricultural education may receive support or make a contribution include:

- instructional technology
- special education
- science education
- curriculum
- environmental education

5. Develop indepth theoretical framework for agricultural education research.

The literature cited in agricultural education research is frequently limited to other agricultural education research. Our research should be carefully tied to the applied sciences of agriculture and education, and rooted in biology, physics, psychology, and/or sociology theories.

6. Plan research programs to develop centers of excellence in agricultural education.

Research initiatives that focus on problems and issues in agricultural education in a programatic and sustained manner are needed for cumulative impact.

7. Include field testing and application components in research initiatives.

The discovery of new knowledge will not necessarily improve a discipline. Means for systematic delivery and application of the new knowledge are equally important. Model agricultural education programs that feature the new knowledge can facilitate use of research findings.

8. Form teams of scientists for agricultural education research initiatives.

Programatic research initiatives (even ones that are well focused) demand resources and expertise beyond those that can be provided by a sole researcher. Effective research teams of the future will include scientists from outside of agricultural education, technicians and graduate students inside and outside of the discipline and will frequently cross state and national boundaries. Multidisciplinary approaches will be needed to solve many of the research problem areas identified.

9. Develop international memorandum of agreement for (MOA) research.

MOAs provide a means for collaborative research on international problems and issues, and at the same time help internationalize our teaching and extension fucntions.

10. Select faculty on the basis of programatic research needs.

The research priorities of a university agricultural education department should be identified and used as a basis for selecting new faculty. Persons filling the positions would be expected to develop a research program in the focused area accompanied by teaching and extension activities.

11. Judge research on its impact.

Research is frequently judged by assessing the process (procedures and methodology employed). As a discipline matures, it should have enough confidence in its research methodology to evaluate research on its educational, social, environmental, agricultural and/or other impact.

12. Rewrite the job description of some university agricultural education professors to include a significant research responsibility.

Research is commonly an add on to teaching and extension duties of many agricultural education faculty. It is time to make research the primary duty of some faculty.

13. Develop a national, regional and state research agenda for agricultural education.

The work by Buriak and Shinn (1989) to develop a national research agenda is very important to the discipline of agricultural education. This should be followed by the development of research agendas at the regional level. Regional agricultural experiment station committees (such as NCA-24) can provide this leadership at the regional level. National and regional priorities should be used in focusing state research initiatives on problems of substance.

14. Analyze national, regional and state studies and plans to identify research priorities.

Understanding Agriculture: New Directions for Education (National Academy Press, 1988) and Strategic Plan for Agricultural Education (National Council for Vocational and Technical Education in Agriculture, 1989) establish national priorities for agricultural education that can be useful in focusing research. State departments of education and state extension services also produce planning documents that can be used in setting research priorities.

SUMMARY

Agricultural education has a critical role to play in the transfer of agricultural technology. For the discipline to realize its full potential, research is needed to light the way. Research adds to the existing knowledge base, helps us critically examine our current practices, and trains graduate students as the new generation of scientists. Our challenge is to develop research programs with focus. This will require teams of researchers pursuing relevant problems in a sustained manner that yield clear solutions; and when applied, provide vigor for the discipline of agricultural education.

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A TIME SERIES ANALYSIS OF AGRICULTURAL EDUCATION STUDENT TEACHERS' PERCEPTIONS OF AGRICULTURAL MECHANICS LABORATORY MANAGEMENT COMPETENCIES

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PROBLEM STATEMENT/REVIEW OF LITERATURE

The student teaching experience has been considered "the single most powerful intervention in a teacher's professional preparation" (Grimmett & Ratzlaff, 1986, p. 41). Few teacher educators question its importance. As such, the influence of the cooperating teacher on the preparation of new teachers is profound. "The selection and preparation of the best cooperating teachers available must receive the attention of educational institutions that require student teaching" (Copas, 1984, p. 49). Yet the role of the cooperating teacher and its practical realities have been largely uncharted (Whaley & Wolf, 1984). According to Hodges, "A need exists for longitudinal studies which take a more in-depth look at teaching variables" (1982, p. 26). In the article "If You Can't Blame the Cooperating Teacher Who Can You Blame?" Hodges reported that topics emphasized in methods courses did not impact the students until they actually experienced those elements.

Much of the secondary agricultural instruction program is devoted to agricultural mechanics instruction. According to Shinn (1987), approximately one-third to two-thirds of this time is devoted to agricultural mechanics. An examination of student teaching follow-up data in North Dakota indicated that the North Dakota student teachers mirrored the percentages discussed by Shinn. Data collected by Luft during 1976 - 1989 indicated that the student teachers devoted approximately 44% of their student teaching experience to the teaching of agricultural mechanics (Luft, 1989).

In light of recent research that suggests (1) some topics emphasized in methods courses did not impact students until they experienced those elements during student teaching (Hodges, 1982), (2) approximately 44% of the student teacher's time was spent teaching agricultural mechanics (Luft, 1989), and (3) the efficient management of the agricultural mechanics laboratory is essential for maximizing student learning (Gleim, 1982; Bear & Hoerner, 1986; Burke, 1986; & Shinn, 1987), the researchers embarked on a study to determine where these laboratory management competencies needed by teachers of vocational agriculture would be best taught. It was reasoned that the results of this study would improve inservice training for supervising teachers as well as that received by future vocational agriculture teachers.

OBJECTIVES

The overall purpose of the investigation was to determine the importance of the competencies needed by high school agriculture teachers as they efficiently manage an agricultural mechanics laboratory as perceived by student teachers before and after their student teaching experiences. Specific objectives were as follows:

1. To determine the student teachers' perceptions of the importance of the agricultural mechanics competencies identified by Johnson and Schumacher (1988) before these agricultural mechanics competencies were taught in an agricultural mechanics teaching methods course (O_1), their perceptions just prior to beginning their student teaching experiences (O_2), and their perceptions of these competencies after completing their student teaching experiences (O_3).

2. To determine the implications for supervising teacher inservice training.

3. To determine the implications for secondary agricultural teacher education.

METHODS

The population for this investigation included all students enrolled in the agricultural mechanics teaching methods course during winter semester, 1989 (N=19).

The time series research design was selected for the investigation. According to Borg and Gall (1983), a "time series design is useful when it is not feasible to form a control group and when the subjects can be measured periodically with the same instrument." Because each student in the class planned to student teach, it was not practical to estabish a control group for the investigation.

The survey instrument designed by Johnson and Schumacher (1988) was used to determine the perceptions of the student teachers. The instrument contained 50 agricultural mechanics laboratory management competency statements. A 1-5 Likert-type scale was provided so that each student teacher could indicate the importance of each competency. The description attached to each point on the scale was as follows: 1 = no importance, 2 = below average importance, 3 = average importance, 4 = above average importance, and 5 = utmost importance.

The competencies identified by Johnson and Schumacher (1988) were developed with input from a panel of nationally recognized agricultural mechanics experts. The 50 competencies were worded exactly as they had been worded in the original instrument. As such, the instrument was judged to be valid.

Cronbach's coefficient alpha was computed each time the instrument was administered. An analysis of the alphas computed revealed reliability coefficients of .92, .88, and .94 for O_1, O_2, and O_3 respectively. The alpha coefficients were very similar to the Cronbach's alpha computed by Johnson and Schumacher (1988).

Frequencies, means, and standard deviations were computed. Analysis of variance was used to determine whether any significant differences existed among O_1, O_2, and O_3 (SAS Institute, 1985; Norusis, 1986).

RESULTS

The data in Table 1 is organized into four parts. Part 1 included those competencies which were perceived as being more important each time the instrument was administered. The student teachers perceived the importance of these competencies to be "above average." The mean values observed for O_3 were 4.1 or higher using a 1 - 5 Likert-type scale. The competency "maintain healthy, environmental conditions in the laboratory" was perceived as the most important competency by the student teachers (O_3, $\overline{X} = 4.76$).

Part 2 of Table 1 included those items which were perceived as being more important just prior to student teaching than they were perceived to be after the student teaching experience. Again, the student teachers perceived these competencies as having "above average" importance. The mean values observed of O_2 and O_3 were 3.8 and higher. Many of these competencies related to safety. For example, the mean value for "provide document safety instruction" dropped from 4.83 to 4.76; the mean value for "conduct regular safety inspections and correct hazardous conditions" dropped from 4.78 to 4.65; and the mean value for "properly install and maintain safety devices and emergency equipment" dropped from 4.72 to 4.65.

Several competencies in Part 3 were perceived to be less important just prior to student teaching than after the student teaching experience. Student teachers perceived these competencies as having "above average" importance. The mean values observed for O_3 were 3.6 and higher. The greatest increase in mean value between O_2 and O_3 occurred for the competencies "plan and implement student recruitment activities for the ag. mech. program" and "develop and/or maintain a file of educational projects and activities.

Part 4 of Table 1 included those competencies which were perceived as being less important each time the instrument was administered. Many of these competencies focused on documentation procedures such as utilizing computerized inventory and billing procedures, documenting the mastery of student competencies, and developing a maintenance schedule for agricultural mechanics lab equipment. The mean values observed for Part 4 were 3.4 and higher. The competency which dropped in importance the most was "develop a written statement of agricultural mechanics lab policies."

Analysis of variance was used to identify five competencies which were statistically significant at the .10 level of probability (Table 2). The student teachers perceived these competencies as being more important after completing their student teaching experience. The competency "maintain healthy environmental conditions" was the only competency statistically significant at the .05 level of probability.

Table 1

Importance of Agricultural Mechanics Laboratory Management Competencies as Perceived by Students Before and After Student Teaching (N = 19)

Competency	O_1 (N=16)			O_2 (N=16)			O_3 (N=16)		
	$\bar{X}$	SD	Rank*	$\bar{X}$	SD	Rank*	$\bar{X}$	SD	Rank*
Part I: Competencies perceived by student teachers as having more importance each time the instrument was administered.									
1. Maintain healthy environ. conditions in lab.	4.38	.62	(13)	4.50	.51	(7)	4.76	.44	(1)
2. Develop ID system to deter tool/equip. theft.	4.00	.63	(33)	4.28	.67	(17)	4.53	.51	(10)
3. Develop procedures for storage/distribution of consumable supplies.	4.19	.66	(20)	4.28	.67	(17)	4.29	.59	(14)
4. Develop procedure to ensure proper ag. mech. lab cleanup.	4.06	.68	(31)	4.22	.55	(20)	4.29	.59	(14)
5. Identify/select current references/tech. manuals.	4.00	.63	(33)	4.17	.38	(22)	4.24	.66	(20)
6. Develop ed. projects and activities for students.	3.86	.62	(40)	4.00	.59	(32)	4.24	.56	(20)
7. Develop/maintain a file of service operator's manuals for ag. mech. lab equipment.	3.81	.54	(45)	4.06	.54	(28)	4.18	.53	(25)
8. Use technical manuals to order replacement/repair parts for ag. mech. lab equipment.	3.88	.50	(40)	4.11	.47	(25)	4.18	.64	(25)
9. Develop procedures for storage checkout/security of tools and equipment.	4.00	.82	(33)	4.00	.49	(32)	4.18	.64	(25)
10. Make minor repairs to the ag. mech. lab facility.	3.75	.58	(45)	4.17	.43	(43)	4.06	.56	(32)

Competency	O_1 (N=16)			O_2 (N=16)			O_3 (N=16)		
	$\overline{X}$	SD	Rank*	$\overline{X}$	SD	Rank*	$\overline{X}$	SD	Rank*
Part II: Competencies perceived by student teachers as having more importance prior to student teaching and less importance after student teaching.									
11. Provide and document safety instruction.	4.69	.60	(3)	4.83	.38	(1)	4.76	.44	(1)
12. Properly install and maintain safety devices and emergency equipment.	4.69	.60	(3)	4.72	.58	(4)	4.65	.61	(3)
13. Conduct regular safety inspections and correct hazardous conditions.	4.50	.63	(8)	4.78	.43	(3)	4.65	.49	(3)
14. Develop/maintain/enforce a student discipline policy.	4.63	.62	(6)	4.72	.46	(4)	4.65	.49	(3)
15. Store/handle/dispose of hazardous materials safely.	4.75	.58	(1)	4.83	.38	(1)	4.59	.71	(6)
16. Select/store/maintain protective equipment for student use.	4.63	.62	(6)	4.67	.49	(6)	4.59	.62	(6)
17. Perform routine maintenance of ag. mech. lab equipment.	4.44	.63	(10)	4.50	.51	(7)	4.41	.51	(11)
18. Maintain ag. mech. lab in compliance with OSHA standards.	4.44	.81	(10)	4.50	.62	(7)	4.35	.70	(13)
19. Promote lab safety by color coding equip., by marking safety zones, and by posting warnings.	4.31	.70	(16)	4.39	.78	(14)	4.29	.59	(14)
20. Arrange equip. in lab to enhance safety/efficiency/learning.	4.38	.50	(13)	4.39	.50	(14)	4.29	.47	(14)

Table 1, Cont.

	O_1 (N=16)			O_2 (N=16)			O_3 (N=16)		
Competency	$\overline{X}$	SD	Rank*	$\overline{X}$	SD	Rank*	$\overline{X}$	SD	Rank*
21. Make minor lab. equipment repairs.	4.38	.62	(13)	4.39	.50	(14)	4.24	.66	(20)
22. Diagnose malfunctioning ag. mech. equipment.	4.44	.63	(10)	4.44	.71	(12)	4.24	.56	(20)
23. Construct/maintain welding booths, work benches, storage areas.	4.13	.72	(27)	4.22	.55	(20)	4.12	.70	(31)
24. Update ag. mech. course offerings. policy.	3.86	.62	(40)	4.06	.54	(28)	3.88	.60	(42)
25. Estimate time required for students to complete projects/activities.	3.94	.68	(38)	4.00	.69	(32)	3.82	.53	(44)
26. Prepare bid specifications and order equip., tools, and supplies.	3.93	.68	(39)	4.00	.49	(32)	3.77	.66	(47)
Part III: Competencies perceived by students teachers as having less importance prior to student teaching but more importance after student teaching.									
27. Administer first aid.	4.69	.60	(3)	4.44	.62	(12)	4.59	.71	(6)
28. Develop an accident reporting system.	4.75	.58	(1)	4.50	.71	(7)	4.59	.51	(6)
29. Identify tools, equip., and supplies required to teach ag. mech. skills.	4.19	.54	(20)	4.17	.57	(22)	4.41	.51	(11)
30. Inventory shop tools, equipment, and consumable supplies.	4.31	.60	(16)	4.28	.67	(17)	4.29	.59	(14)
31. Develop procedure to bill students for project construction materials.	4.19	.75	(20)	4.12	.60	(24)	4.29	.59	(14)

Table 1, Cont.

Competency	O_1 (N=16)			O_2 (N=16)			O_3 (N=16)		
	$\overline{X}$	SD	Rank*	$\overline{X}$	SD	Rank*	$\overline{X}$	SD	Rank*
32. Recognize characteristics of quality tools and equipment.	4.31	.48	(16)	4.06	.54	(28)	4.24	.56	(20)
33. Develop objective criteria for evaluation of student projects/activites.	4.31	.61	(16)	4.00	.69	(32)	4.18	.53	(25)
34. Develop/maintain an adequate inventory of consumable supplies.	4.19	.54	(20)	4.11	.58	(20)	4.18	.39	(25)
35. Arrange for professional serviceperson to make major equip. repairs.	4.06	.85	(31)	3.83	.92	(40)	4.06	.90	(32)
36. Develop/maintain a file of educational projects and activities.	4.13	.62	(27)	3.98	.43	(37)	4.06	.66	(32)
37. Modify facilities/equip. to accommodate handicapped students.	3.88	.89	(40)	3.78	.88	(43)	4.06	.83	(32)
38. Designate equip. work stations for each skill area (cold metal, arc welding, elec., etc.) reporting system.	4.13	.50	(27)	3.94	.64	(38)	4.06	.56	(32)
39. Plan/implement student recruitment activities for ag. mech program.	3.75	.77	(45)	3.67	.49	(45)	4.00	.50	(37)
40. Develop/operate within constraints of budget.	4.19	.54	(20)	3.83	.92	(40)	3.94	.66	(39)
41. Develop rotational plan to move students through ag. mech. skill areas.	4.00	.73	(33)	3.83	.92	(40)	3.94	.56	(39)
42. Install stationary power equipment.	3.88	.62	(40)	3.56	.98	(48)	3.94	.56	(39)

Table 1, Cont.

Competency	O_1 (N=16)			O_2 (N=16)			O_3 (N=16)		
	$\bar{X}$	SD	Rank*	$\bar{X}$	SD	Rank*	$\bar{X}$	SD	Rank*
43. Plan and conduct an ag. mechanics public relations program.	4.13	.50	(27)	3.72	.58	(45)	3.88	.60	(42)
44. Silhouette tool/equip. cabinets.	3.69	.70	(48)	3.22	.73	(50)	3.59	.94	(48)
Part IV: Competencies which were perceived as being less important both prior to and following student teaching.									
45. Develop a written statement of ag. mech. lab policies.	4.50	.52	(8)	4.50	.62	(7)	4.18	.64	(25)
46. Develop a maintenance schedule for ag. mech. lab equipment.	4.19	.40	(20)	4.11	.68	(25)	4.00	.61	(37)
47. Develop a system to document achievement of student competencies.	4.19	.66	(20)	4.06	.54	(28)	3.82	.81	(44)
48. Make major ag. mech. lab equipment repairs.	4.00	.89	(33)	3.94	.80	(38)	3.82	.73	(44)
49. Computerize lab management functions (inventory, billing, accounting. etc.)	3.63	.62	(49)	3.61	.78	(47)	3.53	.51	(49)
50. Maintain computerized student academic records.	3.56	.73	(50)	3.44	.71	(49)	3.35	.86	(50)

O_1 was administered after one week of the agricultural mechanics teaching methods course.

O_2 was administered just prior to the student teaching experience.

O_3 was administered after the students had completed both the agricultural mechanics teaching methods course and the student teaching experience.

* Rankings are provided for each category. The questions are arranged in the table according to the ranking of Test C from high to low ranking.

Table 2

Analysis of Variance Tests Among Respondents by Time of Measurement and the Laboratory Management Competency

	Time of Measurement, N = 17								
	O_1		O_2		O_3				
Competency	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	$\underline{F}$	$\underline{p}$	SiD
1. Develop ID system to deter tool/equip. theft.	4.00	.62	4.28	.67	4.53	.51	2.79	.0779	$1 \neq 3$
2. Make minor repairs to the ag. mech. lab facility.	3.75	.57	3.77	.43	4.06	.56	3.16	.0572	$2 \neq 3$, $1 \neq 3$
3. Maintain healthy environmental conditions.	4.38	.62	4.50	.51	4.76	.44	3.51	.0432*	$1 \neq 3$
4. Identify tools, equipment and supplies required to teach ag. mech. skills.	4.19	.54	4.17	.57	4.41	.51	2.66	.0873	$1 \neq 3$ $2 \neq 3$
5. Develop educational projects/activities.	3.88	.62	4.00	.59	4.24	.56	2.91	.0706	$1 \neq 3$

O_1 was administered after one week of the agricultural mechanics teaching methods course.

O_2 was administered just prior to the student teaching experience.

O_3 was administered after the students had completed both the agricultural mechanics teaching methods course and the student teaching experience.

DISCUSSION

An analysis of Table 1 - Part 1 indicated that these competencies were reinforced by the agricultural mechanics teaching methods course. It also appeared that the student teaching experience reinforced the perceptual importance of these competencies.

The competencies reported in Table 1 - Part 2 appeared to be reinforced by instruction during the teaching methods course. The student teaching experience, however, failed to reinforce the student teacher's perceptual importance of these competencies. This was unfortunate because approximately 50 percent of the competencies in that category were safety-related.

Ten of the 18 competencies in Table 1 - Part 3 specifically related to projects and tools/equipment. Although these competencies were taught as a part of the agricultural mechanics teaching methods course, their perceptual importance declined immediately prior to the student teaching experience. Fortunately, the student teaching experience reinforced the perceptual importance of these competencies.

Table 1 - Part 4 included the competencies which declined in perceptual importance each time the instrument was administered. A comparison of the mean values reported by student teachers and the mean values provided by agricultural mechanics experts (Johnson & Schumacher, 1988) suggest that normal regression had occurred.

All of the competencies which were statistically different at the .10 level of probability differed between O_1 and O_3. Because only two of these competencies were statistically significant between O_2 and O_3, one might inductively reason that the combined effect of the agricultural mechanics methods instruction and the student teaching experience impacted the students' perceptions of these competencies.

CONCLUSIONS

Based on the findings of this investigation, the following conclusions have been drawn:

1. Student teachers recognized the importance of laboratory management when teaching agricultural mechanics. The lowest mean value observed was 3.32 on a 1-5 Likert-type importance scale. The mean values observed were as high and higher than those reported by Johnson (1989).

2. The student teaching experience reinforced competencies relating to tools/equipment, project construction, and agricultural mechanics public relations. Agricultural mechanics methods coursework failed to increase the perceptual importance of these competencies. This conclusion supports the conclusions suggested by Hodges (1982).

3. The perceptual importance for several of the safety-related competencies decreased during the student teaching experience. It should be noted that many of the differences observed were not statistically significant; however, an overview of the data clearly suggested that this trend did exist.

RECOMMENDATIONS

Based on the conclusions drawn from the findings of the investigation, the following recommendations have been formulated:

1. The importance of safety-related competencies should be stressed during supervising teacher workshops and student teacher visits. A trend clearly existed within the data indicating that the student teacher placed less importance on safety- related competencies after having student taught. The trend was not surprising because an analysis of Johnson's (1989) data indicated that the average agriculture teacher in the state placed less perceptual importance on safety-related competencies than did the student teachers.

2. Teacher educators should ascertain criteria for identifying student teaching centers which promote the development of these laboratory management competencies. An overview of the data suggested that some of the competencies may not have been strongly reinforced during the student teaching experience. The competencies which were statistically different, appeared to be positively reinforced by both methods instruction and the student teaching experience.

3. Data collection should be continued from successive groups of Missouri student teachers and should be pooled in order to allow more rigorous statistical analysis. Such analysis may indicate further changes needed in agricultural mechanics methods instruction.

IMPLICATIONS

Much work has been conducted in an effort to determine and validate competencies needed by secondary agriculture students. Johnson and Schumacher (1988) similarly identified and validated the laboratory management competencies required of vocational agriculture teachers. These competencies serve as a guide for teacher educators and, as such, help ensure that student teachers are taught these competencies.

The research identified competencies that (1) were reinforced by both the teaching methods course and the student teaching experience, (2) were reinforced more strongly by the student teaching experience than by the teaching methods course, (3) were reinforced more strongly by the teaching methods course than by the student teaching experience, and (4) declined in importance after both experiences.

Although the number of participants in this study was small and although further research must be conducted to substantiate the findings of the investigation, implications for teacher preparation and inservice instruction for supervising teachers are evident. Items which were positively reinforced during methods instruction and the student teaching experience must continue to be emphasized. Competencies that appeared to be positively reinforced by the student teaching experience but not reinforced during the methods instruction might best be taught in greater depth after the student has student taught. Competencies taught that were not reinforced during student teaching but were reinforced during methods instruction should be carefully examined and discussed with supervising teachers during supervisory visits and during supervising teacher inservice education. Lastly, competencies that were perceived as less important after both the teaching methods course and student teaching should be analyzed in great depth by both teacher educators and supervising teachers.

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DETERMINATION OF THE AGRICULTURAL MECHANICS LABORATORY MANAGEMENT INSERVICE NEEDS OF MISSOURI AGRICULTURE TEACHERS

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According to Phipps (1980, p. 306), "The primary objective of agricultural mechanics education is the development of the abilities necessary to perform the mechanical activities to be done in agriculture ..." This statement implies that, in addition to the classroom component, agricultural mechanics instruction must include an experiential component where students are provided with opportunities to develop manipulative skills.

Since psychomotor skill development is an important part of agricultural mechanics education, much of the instruction takes place in the school agricultural mechanics laboratory. Oomens and Jurshack (1978, p. 39) stated that agricultural mechanics "...laboratory exercises provide the necessary skill development to allow students ... to operate equipment in a proper and efficient manner."

Shinn (1987) stated that the amount of time devoted to laboratory instruction may comprise from one-third to two-thirds of the total instructional time in many agriculture courses. Since laboratory experiences are such an integral component of agricultural mechanics instruction, efficient management of the school agricultural mechanics laboratory is essential in order to maximize student learning (Gliem, 1982; Bear and Hoerner, 1986; Burke, 1986; Shinn, 1987).

Noting the importance of effective laboratory management, Johnson and Schumacher (1989) conducted a study to ascertain competencies needed by secondary agriculture teachers in order to successfully manage an agricultural mechanics laboratory. A list of 50 competencies was developed by using a modified Delphi technique involving the expertise of postsecondary, college, and university agricultural mechanics experts who served on the 1986-1987 National FFA Agricultural Mechanics Contest Committee. Based upon the data collected, Johnson and Schumacher (1989) concluded:

> The identified competencies represent ... skills needed by high school agriculture teachers as they manage an agricultural mechanics laboratory. Teacher educators should provide present and prospective agriculture teachers with experiences designed to develop and enhance these skills (p.28).

PURPOSE OF THE STUDY

The primary purpose of this study was to ascertain the agricultural mechanics laboratory management inservice needs of Missouri secondary agriculture teachers. More specifically, the following research questions were investigated:

1. What are the inservice needs (as indicated by mean weighted discrepancy scores) of Missouri secondary agriculture teachers for the agricultural mechanics laboratory management competencies identified by Johnson and Schumacher (1989)?
2. What is the relationship between the weighted discrepancy scores for each agricultural mechanics laboratory management competency factor and selected respondent demographic characteristics?

PROCEDURES

Population and Sample

The population for this study was composed of all secondary agriculture teachers listed in the 1988-1989 Missouri Agricultural Education Directory (Missouri Department of Elementary and Secondary Education, 1988) who were identified by joint state staff members as having primary responsibility for managing an agricultural mechanics laboratory (N= 240). Based on recommendations by Hair, Anderson, and Tatham (1987), the calculated sample size of 148 (Krejcie and Morgan, 1970) was increased to 200 in order to provide an acceptable respondent to item ratio for factor analysis. The sample of 200 teachers was randomly selected.

Needs Assessment Model

The Borich (1980) needs assessment model provided the evaluative framework for assessing and prioritizing agricultural mechanics laboratory management inservice needs. In accordance with the model, a mean weighted discrepancy score (MWDS) was calculated for each competency using the following formula (Borich, 1980):

$$\text{MWDS} = \frac{\sum\left[(\text{importance rating-ability rating})\ (\bar{\text{X}}\ \text{importance rating})\right]}{\text{number of observations}}$$

According to the rationale underlying the Borich (1980) model, large mean weighted discrepancy scores represent greater inservice needs, while smaller scores represent lesser inservice needs.

Instrumentation

The survey instrument developed by Johnson and Schumacher (1989) was modified for use in this study. The revised instrument contained two sections. The first section contained the 50 identified agricultural mechanics laboratory management competency statements. Two 1-5 Likert-type scales were provided so that each respondent could independently rate (a) the importance of each compentency and (b) their ability to perform each competency. The descriptors attached to each point on the scales were as follows: importance scale (1 = no importance, 2 = below average importance, 3 = average importance, 4 = above average importance, and 5 = utmost importance); ability scale (1 = no ability, 2 = below average ability, 3 = average ability, 4 = above average ability, and 5 = exceptional ability). The second section of the instrument, constructed after a review of previous research, was designed to collect relevant demographic information from each respondent.

The 50 competencies were worded exactly the same as in the original instrument (Johnson and Schumacher, 1989). Since the original competencies had been developed with input from a panel of nationally recognized agricultural mechanics education experts, the revised instrument was judged to be valid. Results of a pilot test conducted with five teachers not selected for inclusion in the sample indicated that no changes were needed in the instrument or research procedures. Instrument reliability was estimated following data collection. Coefficient alphas of .94 (importance scale) and .93 (ability scale) were obtained.

Data Analysis

The SAS (SAS Institute, 1985a) computer program was used for data analysis. Data relative to each research question were analyzed as follows.

Data relative to research question one were analyzed using descriptive statistics. Means and standard deviations were calculated for the respondents' perceptions of importance and ability relative to each compentency. A mean weighted discrepancy score and standard deviation were also calculated for each competency using the formula suggested by Borich (1980).

Data relative to research question two were analyzed using factor analysis and stepwise multiple regression. Principal components factor analysis with varimax rotation was utilized to group the 50 competencies into a smaller number of factors. A composite weighted discrepancy score was then calculated for each respondent for each factor. This was accomplished by summing the weighted discrepancy scores for the items in each factor and then dividing by the number of items in the factor (Hair, Anderson, and Tatham, 1987). Stepwise multiple regression was subsequently utilized to determine if a single or linear combination of respondent demographic characteristics could explain a significant portion of the variance associated with the weighted discrepancy scores for each competency factor. In accordance with recommendations contained in the SAS User's Guide: Statistics (SAS Institute, 1985b), the .15 alpha level was selected as the critical standard for exploratory stepwise regression analyses.

RESULTS

Useable responses were received from 168 Missouri secondary agriculture teachers for an 84% response rate. Multiple analysis of variance indicated that no significant differences ($p < .05$) existed between early and late respondents on their perceptions of importance or ability to perform each of the agricultural mechanics laboratory mangement competency factors. Therefore, the results were judged to be generalizable to the population (Miller and Smith, 1983).

The average respondent reported 11 years of teaching experience and had earned 17 semester credit hours in university agricultural mechanics coursework. The average agricultural mechanics laboratory was 22 years of age and had 3070 square feet of floor space. Table 1 presents a summary of selected respondent demographic characteristics.

The teachers rated the mean importance of 23 (46%) of the competencies 4.0 or higher while 26 (52%) received mean importance ratings of between 3.00 and 3.99. Only one (2%) competency received a mean importance rating of less than 3.00. The agriculture teachers perceived that the competency "provide and document student safety instruction" was the most important competency ($\overline{X} = 4.61$) while "maintain computerized student academic records" was the least important competency ($\overline{X} = 2.91$). Table 2 presents descriptive statistics for the respondents' perceptions of the importance of each competency.

The teachers rated their mean ability to perform two (4%) of the competencies as being 4.00 or higher while 44 (88%) of the competencies received mean ability ratings of between 3.00 and 3.99. Four (8%) of the competencies received mean ability ratings of less than 3.00. The teachers perceived that they were most able to perform the competency "make minor agricultural mechanics lab equipment repairs" ($\overline{X} = 4.06$). They felt least able to perform the competency "modify facilities and equipment to accommodate handicapped students" ($\overline{X} = 2.83$). Table 2 presents descriptive statistics for the respondents' perceptions of their ability to perform each competency.

The mean weighted discrepancy scores ranged from a high of 3.67 for the competency "administer first aid" to a low of -1.04 for the competency "make minor repairs to the agricultural mechanics lab facility." Five competencies received mean weighted discrepancy scores greater than 3.00; each of these competencies was safety related. Forty-eight (96%) of the competencies received positive mean weighted discrepancy scores while two (4%) received negative scores. Table 2 presents the mean weighted discrepancy score (MWDS) and standard deviation for each of the 50 competencies.

A rotated factor pattern consisting of five factors was selected as the optimal factor analysis solution. This decision was based upon examination of the scree plot of eigenvalues and the conceptual soundness of factors (Hair, Anderson, and Tatham, 1987). The five factor solution explained 45.89% of the variance associated with the raw data. Factor loadings for each item in each factor were significant at the .01 alpha level.

The five factors, the number of items in each factor, and the coefficient alpha reliability estimate for each factor were as follows: Laboratory Safety, 12 items, $\underline{r} = .88$; Program Management, 13 items, $\underline{r} =$

.84; Instructional Management and Recordkeeping, 12 items, $\underline{r} = .83$; Inventory Management, 9 items, $\underline{r} = .79$ and Facility and Equipment Repair, 4 items, $\underline{r} = .63$.

The results of stepwise regression analysis indicated that a statistically significant ($p < .15$) portion of the variance associated with the weighted discrepancy scores for each of the five competency factors could be explained by a linear combination of respondent demographic characteristics. However, since the largest percentage of variance accounted for was 8.21% (for the Program Management factor), this finding was judged to be of no practical significance.

CONCLUSIONS

The following conclusions are based upon the findings of this study.

1. Missouri secondary agriculture teachers have inservice needs in the area of agricultural mechanics laboratory management.

2. Each of the five competencies which received a mean weighted discrepancy score of greater than 3.0 was safety related. Therefore, in the area of agricultural mechanics laboratory management, Missouri secondary agriculture teachers have the greatest inservice needs in the area of safety.

3. A high degree of variance was associated with each mean weighted discrepancy score. This indicates that educational needs in the area of agricultural mechanics laboratory management vary among Missouri secondary agriculture teachers.

4. Agricultural mechanics laboratory management inservice needs, as defined in this study, were largely independent of the respondent demographic characteristics investigated.

RECOMMENDATIONS

The following recommendations are based on the findings and conclusions of this study.

1. Inservice programs should be conducted to improve the agricultural mechanics laboratory management abilities of Missouri secondary agriculture teachers. Priority topics should include: a) administering first aid, b) storing, handling, and disposing of hazardous materials, c) providing and documenting safety instruction, d) conducting safety inspections and correcting hazardous conditions, and e) selecting, storing, and maintaining student protective equipment.

2. Agricultural education faculty and state supervisors should be prepared to offer individualized assistance to agriculture instructors who have unique educational needs in the area of agricultural mechanics laboratory management.

3. The content of the preservice agricultural mechanics teaching methods course should be evaluated to determine if additional emphasis should be placed on the development of identified agricultural mechanics laboratory management competencies.

4. Further research should be conducted to identify and validate a common core of laboratory management competencies essential to all phases of laboratory instruction (i.e. horticulture, land, small animal, etc.) in agricultural education.

Laboratory instruction is an important component of agricultural mechanics education. Teacher educators should periodically monitor educational needs in the area of agricultural mechanics laboratory management and use the information collected to plan and deliver timely, relevant instruction to present and prospective agriculture teachers.

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Table 1

Descriptive Statistics for Selected Respondent Demographic Characteristics

Characteristic	n	$\bar{X}$	SD
Total years of teaching experience	168	10.95	8.02
Total semester hours of university agricultural mechanics coursework.	138	17.39	9.93
Average hours per week devoted to agricultural mechanics laboratory instruction.	163	10.14	4.91
Number of students in largest agricultural mechanics laboratory class.	168	15.39	6.02
Average annual number of students receiving agricultural mechanics laboratory instruction.	167	50.79	29.12
Age, in years, of agricultural mechanics laboratory.	160	21.59	12.11
Size (ft^2) of agricultural mechanics laboratory.	150	3070.05	1517.71
Annual agricultural mechanics consumable supply budget ($).	129	2426.71[a]	2442.54
Ft^2 of lab space per student in largest agricultural mechanics laboratory class.	150	223.02	125.56
Annual consumable supply budget ($) per agricultural mechanics laboratory student.	120	51.18[b]	52.63

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[a] Values ranged from $200.00 to $15,000.00.
[b] Values ranged from $5.88 to $441.18.

Table 2

Importance Ratings, Ability Ratings, and Mean Weighted Discrepancy Scores for the Agricultural Mechanics Laboratory Management Competencies

Competency	Importance		Ability			
	$\bar{X}$	SD	$\bar{X}$	SD	MWDS	SD
1. Administer first aid.	4.22	.83	3.35	.92	3.67	4.59
2. Safely store, handle, and dispose of hazardous materials.	4.35	.78	3.57	.84	3.39	3.73
3. Provide and document student safety instruction.	4.61	.63	3.87	.84	3.39	4.00
4. Conduct regular safety inspections and correct hazardous conditions.	4.40	.67	3.69	.81	3.14	3.64
5. Select, store, and maintain protective equipment for student use.	4.28	.77	3.56	.80	3.08	3.66
6. Diagnose malfunctioning agricultural mechanics lab equipment.	4.18	.79	3.48	.62	2.89	3.61
7. Maintain healthy environmental conditions in the lab.	4.26	.77	3.66	.86	2.56	3.56
8. Maintain the agricultural mechanics lab in compliance with OSHA standards.	3.85	.92	3.20	.87	2.49	3.56
9. Promote laboratory safety by color coding equipment, marking safety zones, and posting appropriate safety signs.	3.89	.95	3.26	.86	2.43	4.05
10. Develop a procedure to insure proper agricultural mechanics lab cleanup.	4.14	.82	3.55	.82	2.43	3.89
11. Develop an accident reporting system.	4.14	.92	3.57	.83	2.39	3.94
12. Develop a system to document achievement of student competencies.	3.71	.86	3.10	.79	2.36	3.56
13. Develop objective criteria for evaluation of student activities.	4.00	.66	3.42	.77	2.35	3.33
14. Develop, maintain, and enforce a student discipline policy.	4.52	.66	4.01	.74	2.31	3.47

Table 2 (continued)

Competency	Importance		Ability			
	X	SD	X	SD	MWDS	SD
15. Properly install and maintain safety devices and emergency equipment	4.42	.74	3.90	.80	2.30	3.36
16. Update agricultural mechanics course offerings.	3.94	.81	3.39	.75	2.22	3.46
17. Arrange equipment in the agricultural mechanics lab to enchance safety, efficiency, and learning.	4.20	.73	3.68	.74	2.17	3.62
18. Develop an identification system to deter tool and equipment theft.	4.03	.91	3.53	.90	2.02	4.34
19. Develop a maintenance schedule for agricultural mechanics lab equipment.	3.58	.79	3.05	.81	1.92	3.48
20. Develop a rotational plan to move students through skill areas.	3.73	.82	3.26	.86	1.78	3.32
21. Recognize characteristics of quality tools and equipment.	4.14	.76	3.74	.71	1.61	3.21
22. Develop educational projects and activities for students.	3.92	.73	3.51	.73	1.61	3.25
23. Perform routine maintenance of agricultural mechanics lab equipment.	4.11	.72	3.73	.75	1.58	2.88
24. Develop procedures to facilitate storage, checkout, and security of tools and equipment.	3.77	.87	3.36	.85	1.57	3.86
25. Estimate time required for students to complete projects and activities.	3.52	.79	3.08	.71	1.55	3.46
26. Develop a procedure to bill students for materials used in project construction.	4.01	.84	3.64	.88	1.49	4.32
27. Designate and equip work stations for each skill area.	3.67	.68	3.27	.79	1.46	3.09
28. Identify and select current references and technical manuals.	3.74	.80	3.37	.76	1.44	3.08

Table 2 (continued)

Competency	Importance		Ability			
	$\bar{X}$	SD	$\bar{X}$	SD	MWDS	SD
29. Develop and operate within the constraints of a budget.	4.18	.83	3.84	.83	1.43	3.89
30. Identify tools, equipment, and supplies required to teach mechanics skills.	4.08	.72	3.74	.80	1.41	3.25
31. Develop a written statement of ag mechanics lab policies and procedures.	3.73	.88	3.38	.81	1.27	3.19
32. Make major equipment repairs.	3.66	.88	3.32	.93	1.22	3.48
33. Develop and maintain an adequate inventory of consumable supplies.	3.82	.77	3.50	.72	1.21	3.20
34. Develop procedures for safe, efficient storage and distribution of consumables.	4.35	.78	3.45	.74	1.19	2.79
35. Inventory shop tools, equipment, and consumable supplies.	4.03	.78	3.75	.84	1.18	3.60
36. Modify facilities and/or equipment to accommodate handicapped students.	3.19	.76	2.83	.94	1.15	3.20
37. Plan and conduct an agricultural mechanics public relations program.	3.31	.92	2.96	.84	1.14	3.05
38. Develop and/or maintain a file of educational projects and activities.	3.76	.74	3.46	.77	1.12	3.09
39. Plan and implement student recruitment activities for the agricultural mechanics program.	3.50	.86	3.20	.78	1.06	3.15
40. Develop and/or maintain a file of service and operator's manuals for agricultural mechanics lab equipment.	4.01	.84	3.76	.83	0.98	3.03
41. Utilize technical manuals to order replacement parts for lab equipment.	3.89	.83	3.70	.86	0.75	3.02
42. Prepare bid specifications and order equipment, tools, and supplies.	3.74	.89	3.53	.81	0.56	3.35

Table 2 (continued)

Competency	Importance $\bar{X}$	Importance SD	Ability $\bar{X}$	Ability SD	MWDS	MWDS SD
43. Arrange for a professional service person to make major equipment repairs.	3.71	.97	3.57	.93	0.53	3.05
44. Computerize lab management functions.	3.07	.99	2.95	1.05	0.37	3.98
45. Silhouette tool and equipment cabinets.	3.44	.95	3.22	.99	0.41	3.50
46. Make minor agricultural mechanics lab equipment repairs.	4.12	.81	4.06	.79	0.25	2.88
47. Install stationary power equipment.	3.58	.96	3.52	.84	0.22	3.37
48. Maintain computerized student academic records.	2.91	1.06	2.83	1.05	0.21	3.36
49. Construct welding booths, work benches, storage areas, etc.	3.76	.85	3.80	.70	-0.16	3.28
50. Make minor repairs to the lab facilities.	3.19	1.09	3.52	.92	-1.04	3.70

FACTORS INFLUENCING
SECONDARY MICHIGAN AGRICULTURAL STUDENTS
ABOUT NON-MEMBERSHIP IN THE FFA

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INTRODUCTION

Within the last 14 years there has been a significant decline in the number of students enrolled in agricultural education classes in secondary schools in the United States. Along with this drop in enrollment there has been a drastic drop in the number of students who have become members of the National FFA Organization.

In 1976 FFA membership peaked at 509,735 (Harris, 1986, p.8). The National Future Farmer Magazine (1988-89, p.8) revealed that 1988 national FFA membership stood at 404,900. This was a drop of 104,835 members or a decline of 21% since the peak membership year of 1976.

The FFA membership figures in the State of Michigan reflected a more severe drop in membership. The Michigan Association of FFA had 10,493 members in 1977. This number declined to 5,427 members in 1988 or a decline of 48% (Richard Karelse, personal communication, March 24, 1989). Despite increased recruitment efforts by the FFA organization membership in the FFA has continued to decline.

RELATED LITERATURE

Selland (1968, p. 110) surveyed FFA members and non-members to determine if significant differences existed between the two groups. Selland found that "a high percentage of both members and non-members indicated that such factors as transportation, work responsibilities during the time of meetings, and conflict of meeting time with other clubs were not problems in their being able to attend FFA meetings." Selland concluded that residence was not a factor affecting membership in the FFA, participation in other activities did not affect membership in the FFA, and transportation to activities was not a problem affecting membership. Selland did find that an agriculture student's decision on joining the FFA was affected by whether or not their friends were FFA members.

Parker (1974, p.62) surveyed administrators, teachers, and students in urban schools and found that a majority disagreed with the statement that "members of the FFA in this school are looked at as 'smart' and 'good' kids." Parker also found that the reason most often cited for not joining the FFA was that "the organization did not sound interesting." Parker also found that only six percent of the students surveyed indicated that the reason they did not join the FFA was that "it costs too much." Interestingly enough, Cooper and Nelson (1983, p.20) also studied the effect dues had on FFA membership. They concluded that "only 6% of the non-FFA members indicated the cost of belonging to FFA prevented them from joining."

PURPOSE AND OBJECTIVES

The purpose of this study was to determine why agricultural education students decided not to join the FFA, and to determine if differences existed between various groups of students as to why they did not join the FFA. The specific objectives of this study were:

1. Determine if a student's financial situation played a part in the student's decision on whether or not to join the FFA chapter;

2. Determine if other extra-curricular activities interfered with FFA membership;

3. Determine if student's peers influenced their decision to not join the FFA; and

4. Determine if a student's place of residence influenced whether or not they joined the FFA.

METHODOLOGY

The target population for this study was all students enrolled in agricultural education classes in Michigan during the 1988-89 school year who were not members of the Michigan Association of FFA. The accessible population was all non-FFA member agricultural students in seventy-five percent of Michigan agricultural education programs that had FFA chapters during the 1988-89 school year. Simple random sampling was used to select 88 schools in Michigan to take part in the survey.

The survey that was developed was a Likert type questionnaire. Borg and Gall (1984) wrote that "Likert Scales are probably the most common types of attitude scales constructed." The survey included 31 Likert scale type questions and eight open-ended questions. Tuckman (1972) stated that "The unstructured response, perhaps more commonly called the open-ended question, allows the subject to give his (her) own response in whatever form he (she) chooses."

The survey instrument was reviewed and field tested for improvement, clarity, validity, and reliability. The following procedures were used: (1) selection of a panel to judge content validity, (2) field testing of the instrument for reliability, and (3) reliability testing of the instrument using Cronbach's Alpha Coefficient. Reliability coefficients were determined for the four objectives. Alpha levels for the four objectives ranged from (.63) to (.76).

DATA ANALYSIS

The data was analyzed using the Statistical Package for the Social Sciences (SPSS, Inc., 1987) SPSS/PC+ version. Three statistical methods were used to analyze the data:

1. The Likert scale questions were analyzed using descriptive statistics such as frequencies, percentages, means, and standard deviations;

2. T-tests and Analysis of Variance (ANOVA) were used to examine differences between the students pertaining to gender, grade level, geographic residence, and number of semesters of agricultural class completed; and

3. The open-ended questions on the survey were analyzed by using qualitative research methods. Each response was placed into one of several categories.

RESULTS

The total population of this study was 441 non-FFA member agricultural students. This included male and female agricultural education students who were not members of the FFA in 45 high school agriculture programs in the state of Michigan.

From the total sample of 441 students, 66% (289) were male and 34% (152) were female. The survey found that 35% (154) of the respondents lived in a town, 18% (80) of the respondents lived on a rural farm, and 46% (202) lived in a rural area but not on a farm. The population was made up of 32% (143) freshmen, 33% (147) sophomores, 21% (94) juniors, and 13% (57) seniors. The surveys indicated that 30% (126) had completed one semester of agriculture class, 43% (183) had completed two semesters, 10% (42) had completed three semesters, 12% (51) had completed four semesters, 1% (5) had completed five semesters, and 5% (20) had completed six semesters of agriculture class.

The means indicated that on most questions, males and females did not feel that financial factors prevented them from joining the FFA. However, the t-test indicated that there was a significant difference between males and females on the financial reasons why they did not join the FFA. Table 1 shows the means for males and females relative to financial variables.

The means for respondents by their place of residence showed that none of the three groups felt that financial factors prevented them from joining the FFA. However, once again there was a significant difference in the means of the respondents by where they resided. Respondents who lived on a rural farm were significantly different from the groups of respondents who lived in a town, or in a rural area but not on a farm. Tukey test results are shown in Table 2.

Table 1

T-Test Results for Male and Female Non-FFA Members Pertaining to Financial Variables

		T-test		
Group	Mean	t-value	Degrees of Freedom	2-tailed Probability
Males	2.93	2.29	285	.023 *
Females	2.72			

* Significant at alpha <.05

The means for the last two groups of respondents by grade level and number of semesters of agricultural class completed indicated that financial factors did not prevent the respondents from joining the FFA.

Table 2

Tukey Test Results for Town, Rural Farm, and Rural Non-Farm Students' Differences in Means on Financial Variables

Group	Mean	Town	Rural Farm	Rural Non-Farm
Town	2.91		*	
Rural Farm	2.62			
Rural Non-Farm	2.94		*	

* Denotes pairs of groups significantly different at alpha <.05

The results for the four groups of students indicated that they felt that time constraints did not prevent them from joining the FFA. Also there was no significant differences in the means within the four groups pertaining to the time variables.

Peer variables were also found not to be a hinderance to FFA membership. No significant differences were found within the four groups of respondents pertaining to the peer variables.

Non-FFA member agricultural students indicated that they did not feel that geographic constraints prevented them from joining the FFA. There was a significant difference in the means of respondents by different grade levels. Tukey test results indicate that freshmen significantly differed from other classes on their responses to geographic variables. This is probably due to the fact that most freshmen do not possess a driver's license and therefore have more difficulty attending FFA activities (see table 3).

Table 3

Tukey Test Results for Freshmen, Sophomore, Junior, and Senior Non-FFA Members' Differences in Means on Geographic Variables

Group	Mean	Freshmen	Sophomore	Junior	Senior
Freshmen	2.85			*	
Sophomore	2.59				
Junior	2.50				
Senior	2.77				

* Denotes pairs of groups significantly different at alpha <.05

Research Questions

The following are eight research questions that were included in the non-FFA member survey. These questions were open-ended and asked the students their opinions on several subjects related to this study. The questions either related directly to one of the four objectives or were general questions that pertained to the entire study.

1. What kind of extra-curricular activities do you participate in after school?

The majority of non-FFA members indicated that sports was the extra-curricular activity in which they most often participated. Work, cars, friends, and clubs were also listed as other extra-curricular activities that took up non-FFA members' time. The following are comments made by the non-FFA members who were surveyed.

"Football - wrestling and in the spring I work on a farm"

"Work and work on cars"

"Spending time with friends"

"Student council, national honor society, S.A.D.D."

2. What was the most important factor that influenced your decision to not join the FFA?

A very large majority, 54% (183), responded that the most important factor that influenced their decision on FFA membership was their level of interest in agriculture. Other factors that influenced the respondents decision on membership included time constraints, friends not in agriculture, money, or transportation. The following are quotes from non-FFA members on important factors that influenced their decision on FFA membership.

"I'm not interested"

"Not enough time"

"My friends"

"Dues too expensive"

3. How do you and your fellow students feel about the agricultural education students who join the FFA and participate in chapter activities?

A majority of non-FFA members indicated that they felt that FFA members were nice students who were no different from non-FFA members. A smaller group of respondents indicated that they felt that FFA members were successful, ambitious students. Other groups of respondents indicated that they did not care, or that FFA members were disliked. Some of the comments were:

"They are all pretty nice"

"We like them and we think there {sic} doing a great job."

"Don't even think about it"

"They're Farmers"

4. What would have influenced you to join the FFA?

The largest group of respondents indicated that nothing would have influenced them to have joined the FFA. Other groups indicated that if they had more time, or more friends in the FFA they would have joined. Smaller groups of respondents indicated that more interesting activities, or more knowledge about the FFA would have influenced them to join the FFA. Additional comments were:

"Nothing, I don't like farming"

"If my friends joined"

"More interesting"

"Knowing more about it"

5. Define agriculture.

The majority of answers included references to farming, plants, or animals. A very small percentage, 6.3%, responded that agriculture had something to do with science. Some of the definitions were:

"Study of farming"

"Agriculture is the growth, harvest, and sales of crops."

"Agriculture is the study of animals, plants, and tractors."

"Agriculture is the science of producing crops, animals, and other things for public consumption."

"Science that deals with knowledge and care of living things."

"Hard work that pays squat" {sic}

6. Why did you enroll in agricultural education class(es)?

Non-FFA members responded that they were either interested in agriculture, they needed a science credit, they thought it would be an easy class, or they were forced to enroll. Some additional reasons given were:

"Because I wanted to learn more about horses"

"Because I needed a science credit"

"Easy science credit"

"I got stuck in it and couldn't get out"

7. In your opinion, what is the best way to help cover the costs associated with FFA membership?

Non-FFA members indicated that they thought the best ways of covering the costs of FFA membership were; fund raisers, individual jobs, parents, or the chapter treasury. Some additional means were:

"More FFA sales"

"Working on farm"

"Get a part time job"

"Have parents pay for it"

"Don't join"

"Club pays expenses"

8. What kind of experiences or background do you have in agriculture?

Non-FFA members indicated that they had a variety of different experiences in the area of agriculture. The largest group indicated that they had little or no experience. Other groups responded that they worked on a farm, lived on a farm, raised animals, had relatives who lived on a farm, gardened, or participated in agricultural class activities. Some additional responses were:

"Absolutely nothing"

"I helped on a farm during summer"

"I live on a farm and work on a dairy farm"

"I have been around farm animals all my life although I don't live on a farm. Some of my relatives do."

"My dad owns a farm and I work on it in the summer"

"I've planted gardens & flowerbeds but that's about it."

"Just horticulture class"

"None, other than what I learned in class"

CONCLUSIONS

Based on the results of this study, the following conclusions were formulated:

1. Financial problems did not restrict respondents from joining the FFA organization.
2. Time conflicts with other activities did not stop respondents from joining the FFA.
3. An agricultural education student's friends did not influence their decision on membership in the FFA.
4. Geographical factors did not prevent respondents from joining the FFA.
5. Males and females differed in their reasons why they chose not to join the FFA organization.
6. Respondents with different places of residence differed in their reasons for not joining the FFA.
7. Non-FFA members spent a lot of their free time playing sports or working at jobs after school.

8. Respondents who had not joined the FFA had not been shown how they would benefit from membership.

9. FFA members were seen as nice students who were ambitious and successful in their FFA activities.

10. Non-FFA members felt that nothing would have convinced them to join the FFA.

11. Non-FFA members had a very limited knowledge of the subject areas that are included in the field of agriculture.

12. Non-FFA members had an interest in learning about agriculture even if they did not wish to join the FFA.

13. Respondents felt that fund raisers should be used to help defer the costs associated with FFA membership.

14. Non-FFA members had a wide range of experiences in agriculture that could have been used as a base to peak their interest in agriculture and the activities of the FFA.

RECOMMENDATIONS

Based on the conclusions of this study, the following recommendations were made:

1. FFA chapters should make every effort to ensure that all agricultural education students are able to attend meetings and other activities.

2. FFA chapters should strive to offer activities for both rural and non rural students.

3. Sports and other recreational activities should be included in the program of activities of all FFA chapters.

4. Students should be shown the non-agriculture related benefits to FFA membership.

5. An alternative dues structure should be investigated to alleviate the burden of requiring students to pay for activities that are intra-curricular to the agricultural curriculum.

6. The agriculture experiences of non-FFA members should be used as a base to develop new courses that would be of interest to all students. These classes should be geared to the interests of students who want a basic knowledge about related agriculture pursuits.

7. New FFA programs on the local, state, and national level should be developed that would be directed toward projects in which non-farm students are likely to show interest.

8. Additional research studies should be undertaken that would survey FFA members to determine their reasons for joining the FFA.

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A TIME ANALYSIS OF AGRICULTURAL EDUCATION STUDENT TEACHERS' PERCEPTIONS OF AGRICULTURAL MECHANICS LABORATORY MANAGEMENT COMPETENCIES

A Critique

Jerry L. Peters, Purdue University--Discussant

It has been reported that the amount of time devoted to laboratory instruction may comprise from one-third to two-thirds of the total instructional time in many agriculture courses. Since laboratory experiences are such an integral component of agricultural mechanics instruction, the researchers have established a solid basis for their study through a strong literature review. The purpose of their study was to determine student teachers' perceptions of the importance of agricultural mechanics competencies: 1)prior to an agricultural mechanics methods course, 2)prior to student teaching, and 3)after student teaching. The researchers are to be commended for conducting an interesting and relevant study. It certainly provides teacher educators with important information to help plan and deliver more appropriate instruction in agricultural mechanics teaching methods courses.

Strengths

1. The introduction was concise yet logically developed to provide a theoretical basis for the development of the research problem.
2. The purpose and objectives were clearly stated.
3. The summary data were presented in a concise manner, and statistical analysis techniques were appropriate, given the nature of the data and the purpose of the study.
4. The results were presented in a clear, concise manner with the use of detailed tables and accompanying narrative.
5. The conclusions and recommendations are clearly stated and supported by the reported results.

The following ideas/questions are offered for the purpose of improving this paper and similar studies in the future.

1. In a similar study conducted by Johnson, Schumacher and Stewart (1989) they found that Missouri secondary agriculture teachers have the greatest inservice needs in the area of safety yet in this study student teachers perceived safety competencies of having more importance prior to student teaching and less importance after student teaching. Can this be explained?
2. Based on the results of this study how much influence could the supervising teacher have had on the student teachers perceptions on the competencies measured after student teaching?
3. The "Rank" column on Table 1 was confusing. The footnote provided explained that the questions were arranged in the table according to the ranking of Test C, yet the text does not refer to such a test. This part of the table could have been explained in more detail or excluded from the study if the informaton is not significant to the study.

Once again the researchers are to be commended for an excellent study and hope they will continue this line of inquiry at North Dakota State and Mississippi State.

DETERMINATION OF THE AGRICULTURAL MECHANICS LABORATORY MANAGEMENT INSERVICE NEEDS OF MISSOURI AGRICULTURE TEACHERS

A Critique

Jerry L. Peters, Purdue University--Discussant

This study addresses an important area of concern, especially as agricultural educators consider the inservice needs of agriculture teachers in the area of agricultural mechanics. The research effort of this study was to ascertain the agricultural mechanics laboratory management inservice needs of Missouri secondary agriculture teachers. The researchers have provided a conceptual framework which leads into a clearly stated purpose. The results of this study provide Missouri teacher educators with important information to help plan and deliver relevant inservice instruction in the area of agricultural mechanics.

Strengths

1. A key ingredient in this study was the use of a list of 50 competencies needed by agriculture teachers as they manage an agriculture mechanics laboratory. These competencies were identified in a previous study by the researchers.
2. The introduction is concise and provides a theoretical basis for the development of the research problem.
3. The purpose and procedures of the study were clearly stated.
4. The results were reported clearly and concisely and were supplemented with appropriate tables.

The following ideas/questions are offered for the purpose of improving this paper and similar studies in the future.

1. Eventhough a pilot test on five teachers revealed very high instrument reliability on both the importance scale and ability scale, the paper does not indicate if reliability checks were made on the scales in this study.
2. Early and late respondents were compared to determine if there were significant differences. None were reported to be found, however, nothing was mentioned in the paper as to what was done with the 32 nonrespondents.
3. It would have helped this reader if a brief summary were added to the paper on how the data was collected
4. For information purposes only this reader would like to have seen which competencies fit into each of the five factors identified.
5. In Table 1 why did only 138 of the 168 teachers respond to the question concerning total semester hours of university agricultural mechanics coursework?
6. In Table 1 why did only 129 of the 168 teachers respond to the question concerning annual agricultural mechanics consumable supply budget? Did they not have budgets?

Once again the researchers are to be commended for an excellent study. The recommendations for inservice programs and further research study in this area are worthy suggestions.

FACTORS INFLUENCING SECONDARY MICHIGAN AGRICULTURAL STUDENTS ABOUT NON-MEMBERSHIP IN THE FFA

A Critique

Jerry L. Peters, Purdue University--Discussant

If FFA is an important component in the development of a well-rounded individual then why is it that all FFA Chapters do not have 100% of the agricultural education students enrolled as members? The researchers of this study are to be commended for trying to identify factors that may have been influencing agricutural students to not become members of the FFA in the State of Michigan. The results from this study may be very useful to those secondary agricultural education programs wishing to improve their FFA membership. This study also lays the groundwork for other states that might wish to conduct a similar study.

Strengths

1. The introduction and related literature established the importance and need for such a study.
2. The purpose and objectives of the study were clearly stated.
3. The researchers are to be commended for having a 100% response rate.
4. The researchers are also to be commended for doing a thorough job of developing and field testing the instrument.
5. The research methodology was sound and the findings useable. The majority of the conclusions and recommendations were supported by the data.

The following ideas/questions are offered for the purpose of improving this paper and similar studies in the future.

1. How was the survey instrument administered? What were the procedures used to obtain the 100% response rate in 45 different high schools in Michigan?
2. Immediately after Table 2 the researchers indicate that results were obtained from four groups of students. These results do not relate to Table 2 or Table 3. It would have helped the flow of the paper if this paragraph was explained in more detail and the four groups of students identified.
3. It was not clearly brought out in the paper that the survey instrument contained four subparts. How many items on the instrument were related to the financial subpart, peer subpart, time subpart and residence subpart?
4. On some of the responses to the eight open-ended research questions percentages were given. Is it possible to get a percent response to Question 6 which asks why they enrolled in agricultural education?
5. Since the paper did not include the specific 31 items of the instrument, how did males and females differ in their reasons for choosing not to join FFA and how were the respondents who lived on a rural farm different from the other subgroups?
6. Did the researchers have a definition of agriculture in mind before the sutdy in order to conclude that non-FFA members had a limited knowledge of the subject areas that are included in the field of agriculture?
7. Does the data really support the recommendation that sports and other recreational activities should be included in the program of activities of all FFA chapters?

VOCATIONAL-TECHNICAL FACULTY EFFICACY: ITS RELATIONSHIPS AND IMPLICATIONS

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How important are personal beliefs of agricultural and other vocational educators? Could task competency and outcome control beliefs reflect a teacher's attitudes and performance? What personal and organizational variables are important to fostering educator beliefs about task competency and outcome control? Such questions appear important to the profession although little research has been done. This lack of research is puzzling because of the increasing concern for teacher and faculty empowerment and the importance of theoretical development and knowledge generation about job attitudes.

PROBLEM STATEMENT

Efficacy beliefs appear to be an important construct for agricultural and other vocational educators to understand and use in working with teachers. In the broadest sense the word "efficacy" may be defined as the personal conviction that effective use of skills will bring about a personally desired outcome. From this definition, efficacy has at least two dimensions: task capability and outcome control (White, 1959: Bandura, 1986). Efficacy dimensions appear to be worthy focuses for research, and in connection with an attitude like job satisfaction, a theoretical framework may be provided and tested. No research, however, has been found on efficacy for vocational-technical educators.

The limited educational research on efficacy has described it as a potentially significant factor for both teacher and learner, and it may be hypothesized as being related to many personal and organizational factors. Gibson and Dembo (1984), Betz and Hackett (1986), and Ashton and Webb (1986) have specifically called for research on the relationships between efficacy beliefs and job satisfaction.

OBJECTIVES

The major objectives of this study were (1) to describe levels of two efficacy dimensions and the level of job satisfaction of two-year college vocational-technical faculty in Ohio, (2) to determine the nature and strength of various relationships with efficacy beliefs and job satisfaction, (3) to determine the best predictors for each efficacy dimension and job satisfaction from the selected variables studied, and (4) to test the congruence of an efficacy model in relation to job satisfaction.

THEORETICAL FRAMEWORK

Theoretical frameworks are found in the literature for studying beliefs. First, beliefs are related to attitudes (Fishbien and Ajzen, 1975). Second, efficacy beliefs may be related to any number of personal and environmental outcome variables (Bandura, 1986). Third, efficacy beliefs may be theorized as having two dimensions: task efficacy and control efficacy (White, 1959).

One dimension of efficacy, the belief of task capability, is referred to by Bandura (1986) as self-efficacy (SE). Self-efficacy is defined as the extent to which individuals believe that they have the capacity to perform specific actions in the environment. Bandura has used self-efficacy as a central construct in his Social Learning Theory in order to explain the cognitive, social, and behavioral activities of people. According to this theory, self-efficacy would appear to be critical to educator's job attitudes, self-regulation, and task performances.

Another dimension of efficacy, the belief of personal control of outcomes, or personal control (PC), also appears important to faculty performance and success. Personal control is defined as the individual's beliefs, at a given point in time, in his or her ability to effect change in a desired direction on the environment (Greenberger and Strasser, 1986). Personal control is a belief that reflects the degree of control over the outcome of some situation, as opposed to self-efficacy which is the evaluation of one's ability to perform in a competent manner. Personal control would appear to be important to educators for its links to intrinsic motivation and creative processes.

Job satisfaction (JS) is an important outcome attitude and variable. The underlying theory for testing job satisfaction in this study was that job attitudes, like job satisfaction, are built upon individual beliefs (Fishbien and Ajzen, 1975). Beliefs are viewed as assessments of what a person thinks is true or false, whereas attitudes describe the negative or positive feelings about an attitude object (Dillman, 1978). According to Fishbien and Ajzen (1975), these beliefs and attitudes are the basis for intentions to perform and for observable performance.

Other factors that may be related to beliefs and attitudes and may explain professional development of faculty are amount of formal education (EDUC), K-12 teaching experiences (K-12 TEXP), practical work experiences (P EXP), tenure on current job (TENURE), number of professional development activities over the past year (NPDA), and the number of hours spent on professional development activities per week (PDHPW). Professional development has become an increased concern for vocational and technical education administrators (Adams, 1985), but little research was found on professional development characteristics that relate to beliefs and attitudes. The relation of various professional development characteristics with efficacy beliefs appears to have merit for implementing policy as well as teacher or faculty supervision.

METHODOLOGY

The design of this study was correlational. The intent of the study was to utilize data obtained in a self-administered survey to describe variables and investigate theoretical relationships.

Subject Selection. The target population of this study was the vocational-technical faculty of Ohio's two-year colleges. Four colleges were purposefully selected. An appropriate sample size for the statistical needs in this research was determined to be approximately 260 vocational-technical faculty. A simple random sample of 259 was drawn from the accessible faculty.

Instrumentation. Five instruments were used to collect data for this study. Self-efficacy, was measured by adapting Schoen and Winocur's (1988) concept about measurement of teaching and administrative tasks self-efficacy. Personal control was measured with an adapted version of Greenberger and Strasser's (1986) Personal Control Scale. The major dependent variable, job satisfaction, was measured by the Minnesota Satisfaction Questionnaire (MSQ), Short Form. A two item institutional responsiveness to faculty development (IR) instrument was developed by this researcher. A leadership style (LS) instrument was developed by adapting Vroom and Yetton's (1981) decision-making style leadership scale.

Data Collection. Data collection for this study was from May 18 to July 6, 1989. Questionnaires were delivered by an administrative officer at each college to each faculty member in the sample. Questionnaires were returned by mail by the respondent.

Analysis of Data. Descriptive statistics were used to organize and summarize the data. Correlational statistics, t-test, ANOVA, and regression statistics were used to answer the formulated hypotheses. Data were analyzed by means of a personal IBM computer using the Statistical Package for Social Sciences (SPSS*pc).

RESULTS

Characteristics of Respondents

A total of 191 faculty in four Ohio two-year colleges returned questionnaires. This represented 74 percent of the sample and 54 percent of the accessible faculty population. There were 52 business, agriculture, or public service faculty, 67 health related faculty, and 72 technical or engineering faculty. Seventy-seven faculty came from community colleges, and 114 came from technical colleges. One hundred five faculty came from urban campuses and 86 came from rural campuses. There were 100 males and 91 females. Ages ranged from 26 to 68 with an average age of 42 years. One hundred twenty-three responding faculty had education equal or greater than a masters degree, and the faculty had on average over 11 years practical work experience. Postsecondary experience was mostly accounted for by the faculty' current college.

Description of Instrument Data

Data were drawn from several instruments. The belief and attitude instruments for this study demonstrated high internal consistencies. Cronbach's alpha coefficients were .95 for self-efficacy, .82 for personal control, and .89 for job satisfaction. On a five point Likert scale, the mean for self-efficacy was 3.80, for personal control was 3.28, and for job satisfaction was 3.81. For the two dimensions of job satisfaction measured, the mean score for intrinsic job satisfaction was 4.15 and the mean score for extrinsic job satisfaction was 3.18. The measure of institutional responsiveness to faculty professional development was 3.12. The most common leadership style of immediate supervisors was determined with a normative measure to be collaborative. A relatively normal distribution was found for each of these variables.

CONCLUSIONS

As shown in Table 1 self-efficacy and personal control were found to be significantly related to each other ($r=.39$; $p<.05$). Self-efficacy was not significantly related to job satisfaction ($r=.10$; $p<.05$); however, personal control was substantially related to job satisfaction ($r=.53$; $p<.05$). Furthermore, significant predictor variables of personal control were institutional responsiveness to professional development ($r^2=.17$; $p<.05$) and self-efficacy ($r^2=.11$; $p<.05$). The major predictor variables for self-efficacy were personal control ($r^2=15$; $p<.05$) and amount of formal education ($r^2=.14$; $p<.05$). The major predictor variables for job satisfaction were institutional responsiveness to professional development ($r^2=.33$; $p<.05$) and personal control ($r^2=.12$; $p<.05$).

Self-efficacy and personal control were successfully combined to form an efficacy construct with high internal consistency (Cronbach's alpha=.95). This overall efficacy construct was significantly related with job satisfaction ($r=.24$; $p<.05$), self-efficacy ($r=.96$; $p<.05$), personal control ($r=.62$; $p<.05$), formal education ($r=.33$; $p<.05$), tenure ($r=.24$; $p<.05$), and number of professional development activities ($r=-.30$; $p<.05$). There was a consistency found in all variables across type of college and type of program area in this population.

Additionally, this exploratory study did provide other new knowledge about beliefs and attitudes. Some conclusions are given in subsequent sections of this paper.

Table 1
Correlation Matrix for All Variables
(Pairwise; n>27)

Variables	JS	SE	PC	IR	LS	SEX	AGE	EDUC	K-12	TEN	PEXP	TYPE	NPDA	PDHPW	EFF
JS	1.00	.10	.53*	.56*	.37*	-.06	.07	-.15*	.06	-.08	.02	-.11	-.04	.11	.24*
SE		1.00	.39*	.06	-.05	.05	.10	.38*	.16	.23*	.00	-.14	-.29*	.08	.96*
PC			1.00	.41*	.33*	-.18*	.08	.03	.16	.14	.00	-.13	-.22*	.15*	.62*
IR				1.00	.28*	-.10	.06	-.06	.11	-.10	.10	-.24*	-.26*	.18*	.16
LS					1.00	.10	.09	.14	.12	-.00	-.03	.04	-.08	.07	-.05
SEX						1.00	.02	.13	-.09	.05	-.13	-.07	.11	-.06	.03
AGE[a]							1.00	.12	.40*	.52*	.43*	-.10	.03	.01	.10
EDUC								1.00	-.04	.25*	-.03	-.07	-.03	-.07	.33*
K-12 TEXP									1.00	.10	-.01	-.03	-.28	-.11	.21
TENURE										1.00	-.02	-.08	-.01	-.09	.24*
P EXP											1.00	-.12	-.02	.11	.00
TYPE[b]												1.00	.19*	-.19*	-.15
NPDA													1.00	-.25	-.30*
PDHPW														1.00	.11
EFF															1.00

* P < .05

a: 1 = male; 2 = female

b: 1 = community college; 2 = technical college

The Belief of Self-Efficacy

New understanding of the importance of the belief about tasks competence for educators has been gained in this study. Bandura (1986) has determined that self-efficacy is built through (1) performance accomplishments, (2) vicarious learning from others, (3) persuasion from others, and (4) emotional arousal. In support of this theory, the findings in this study showed that self-efficacy was significantly related (a) to number of professional development activities (r=-.29; p<.05) which may be seen as performance accomplishment or/and vicarious learning, (b) to the amount of formal education (r=.38; p<.05) which may be seen as vicarious learning, (c) to tenure (r=.23; p<.05) which may be seen as performance accomplishment, and (d) to personal control (r=.39;p<.05) which may be seen as emotional arousal. Therefore, support was provided for Bandura's (1986) Social Learning Theory.

Since tenure and number of professional development activities were significantly related to self-efficacy, this also supports Bandura's argument that self-efficacy beliefs appear to influence choice of work activities, effort expended, and length of effort expended. It should be pointed out however that K-12 teaching experience, practical work experience, and amount of time spent on professional development were not significantly related to self-efficacy in this population. The lack of relationship with these professional development factors was a surprise in light of Bandura's argument. In search of possible explanations of these findings, it appears that current beliefs about personal control of work situations, feeling of satisfaction for teaching, and degree of perceived caring of administrators for teacher development needs are perceived as more critical for teacher development than past teaching experiences. Second, the lack of association with practical work experiences may indicate that vocational faculty with a short base of practical experience is satisfactory if formal education provides up-to-date information and formal professional level pedagogical skills. Third, the type of professional development activities that build intrinsic motivation and focus on individualizing formal education attainment may be more important to building self-efficacy than if faculty simply fulfill standardized professional development requirements.

Paradoxically, in this population the number of professional development activities undertaken by faculty, which indicates a high exposure to vicarious learning as well as amount of effort expended, was negatively related to self-efficacy. That is, faculty with a high measure of self-efficacy performed fewer professional development activities and those with lower self-efficacy performed more. This relationship was surprising. It is generally assumed that competent teachers are professionally active and that currently prescribed professional development activities will continually increase teacher competence. An apparent explanation may be those faculty with high competency beliefs use other than common approaches, and those with low confidence are more engaged in customary developmental activities. Or, it may also mean that highly competent faculty feel that they don't have sufficient time, interest, or energy to pursue very many professional development activities and don't, and that faculty with lower competency beliefs perceive they are required to pursue these activities mainly for the reason of keeping their jobs.

Furthermore, it can be concluded that vocational-technical educators in this population had significantly higher confidence in their abilities to perform teaching tasks than administrative tasks. Despite calls for more faculty influence in organizational and administrative matters, faculty do not appear to either desire administrative competence or have not been given the opportunities to develop such competencies. Neither males nor females appeared to be different in beliefs about teaching self-efficacy or administrative self-efficacy.

The Belief of Personal Control

Since personal control was moderately related to self-efficacy ($r=.39$; $p<.05$) and was a major predictor of self-efficacy ($r^2=.15$; $p<.05$), it appears to be an important antecedent variable related to task competency and therefore to factors involving task self-regulation. In accord with self-efficacy, personal control was negatively related to number of professional development activities attempted over the past year ($r-.22$; $p<.05$), and indicate incongruity between high efficacy beliefs and professional development activities.

Personal control was found to be related to several different variables than self-efficacy and appears to measure a different belief. Because of this divergence of associations with the selected variables, it appears that personal control measures a different belief dimension of efficacy. Major significant differences in the two efficacy dimensions were found in variables that tended to predict the different dimensions. Job satisfaction had substantial personal control predictive ability ($r^2=.28$; $p<.05$) while it had minimum predictive abilities for self-efficacy ($r^2=.00$; $p<.05$). Amount of formal education had substantial self-efficacy predictive ability ($r^2=.14$; $p<.05$), but it had minimum personal control predictive ability ($r^2=.00$; $p<.05$).

Sex and the estimated number of hours per week devoted to professional development activities (PDHPW) were two other variables significantly related to personal control and not to self-efficacy. Men tended to perceive themselves as having more personal control than women in this population ($r=.18$; $p<.05$). This finding may be important to understanding conflicting research that has showed low self-efficacy related to women employees (Dean, 1989). These findings suggest that beliefs about tasks competency between gender may not be as important in current job situations as gender beliefs about abilities to affect change in the environment through a degree of personal control.

The number of estimated hours devoted per week to professional development (PDHPW) activities was significantly related to personal control ($r=.18$; $p<.05$) and not to self-efficacy. This findings indicates that the ability to make personal choices appears to complement the effort expended toward professional development. In summary, the personal control construct used in this research appears to be a new and exciting prospect for understanding more about educator competency as well as professional development needs.

The Attitude of Job Satisfaction

Vocational-technical faculty in the accessible population were satisfied with their jobs. A comparison of job satisfaction scores with other populations that have been measured with the MSQ Short Form may be of interest since published average mean scores of the MSQ Short Form are available (Weiss, Dawis, England, and Lofquist, 1967). This population's converted job satisfaction score was 72 and is lower than scores of office clerks (74), engineers (78), janitors and maintenancemen (78), machinists (76), and salesmen (80). Only assemblers had lower job satisfaction scores (70). Recently, and in a related field of education, trade and industrial high school vocational educational teachers had a mean average score of 75 (Peterson and Edmunds, 1988).

The ability to predict job satisfaction was accounted for by both personal (35%) and organizational (37%) variables in this study. Since traditionally the ability to predict job satisfaction is mainly accounted for by organizational antecedents (Glisson and Durick, 1988), this study indicates that beliefs may be overlooked as job satisfaction variables. Furthermore, since 12% of the ability to predict job satisfaction was accounted for by personal control when major personal and organizational variables are regressed, it appears that the efficacy dimension of personal control may be crucial to educator job satisfaction. This finding supports the recent findings by Greenberger, Strasser, Cummings, and Dunham (1989) that personal control is an important construct for studying job satisfaction. Clearly, more should to be known about personal control in vocational education settings.

The Professional Development Factors

Organizational variables like perception of institutional responsiveness to faculty development and of a collaborative leadership style showed no significant association with self-efficacy. However, institutional responsiveness to faculty development needs was associated with job satisfaction ($r=.56$; $p<.05$) and personal control ($r=.41$; $p<.05$). Also, a more collaborative leadership style was associated with job satisfaction ($r=.37$; $p<.05$) and personal control ($r=.33$; $p<.05$). Since personal control was a major predictor of self-efficacy, variables like institutional responsiveness and leadership style appear to be indirectly related to self-efficacy through personal control. Thus, efficacy beliefs appear to be related to organizational variables, perhaps because of the intrinsic motivational needs of faculty to feel able to change their environment in some desired direction.

IMPLICATIONS

Practical Implications

Practical implications derived from findings in this study are numerous. First, policy makers and administrative designers of professional development programs may want to specifically acknowledge the faculty efficacy needs involving task competency and personal control. To increase faculty efficacy, the findings in this study suggest that supervisors may want to provide professional development programs that encourage and enable faculty to have personal control over their work environment. This includes ways to participate in institutional decisions making, to provide for both teaching and administrative professional skills development, and to offer a positive and collaborative leadership style. Also, setting tasks competency guidelines may be important in reducing existing forms of discrimination such as partisanship, sex, and race. A program involving counseling and individualizing professional and career development should be provided. Since job satisfaction was found to have a negative relationship with formal education attained, the special needs of faculty with higher degrees should be studied and programs devised to meet some of their intrinsic needs.

Most of the educators in the population studied were tenured, and they had an average of over 9 years at their present college and little teaching experience in other settings. A prime concern may be how to develop programs that promote high efficacy and job satisfaction of faculty with long tenure in one educational setting. Hall and Associates (1987) have provided several general guidelines to provide for professional development needs which may be adapted. First, management and policy should provide planned opportunities for the stimulation of awareness of career choice and exploration. Second, a professional growth environment should be fostered which may include realistic job performance appraisals, rewards for mentoring activities, and opportunities for formal educational upgrading. Third, new job opportunities should be provided through job brokers for employees, lateral moves within institution, district, or state, and educational or work leaves-of-absence. Fourth, other interventions may include provisions for experience-enhancing work roles (project work, grant writing, and administrative duties), counseling, and formal career-planning programs. Such efficacy building interventions should help to focus and sustain a vocational faculty.

Other practical implications point to ways for local supervisors to alter individual faculty beliefs. Like intrinsic motivation, faculty efficacy appears to be unique and highly individualistic and should be approached in that way. Job orientation for new faculty may be critical for setting efficacy beliefs, and much more resources and thought about efficacy building activities may be needed. It is likely that change of efficacy beliefs, once set, are likely to come slowly over a period of time and must be coupled with salient experiences. To change individual faculty beliefs, supervisors should provide for outlets for meaningful individual inputs, such as decision-making involvement. Appropriate individual role modeling, mentoring, feedback, and recognition rewards should be provided by familiar supervisors. Supervisors should also provide ways of increasing participation in the overall organizational goals and purposes. Finally, supervisors should continually provide clear tasks, goals, and rewards for each faculty member. Individual faculty work design and information needs concerning task responsibilities, objectives, and evaluations should be determined on a one-to-one, personal basis whenever possible in order to maximize faculty personal control. In summary, it appears that enhancing personal control and tasks information and expectations are appropriate focuses for immediate supervisors to alter faculty efficacy beliefs.

Research Implications

There are several research implications. There needs to be further correlational and experimental research in educational settings for both self-efficacy and personal control in order to map the efficacy terrain. Research should be done at different times of the school year, in different states under different systems, and in different local programs, institutions, and locations. Experimental research measuring educator performance while providing efficacy counseling or other interventions is a possibility. Future research on efficacy beliefs should be extended to pre-service training of educators. Longitudinal studies involving career efficacy development is recommended. New theory on beliefs involving educator development should be built through qualitative, case, and critical research studies since the subjectivity of individuals is used.

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THE ASSOCIATION BETWEEN COOPERATING TEACHER AND TEACHER EDUCATOR EVALUATIONS OF STUDENT TEACHING PERFORMANCE

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INTRODUCTION

Scholars are generally in agreement that the student teaching experience is the cornerstone of the teacher education program. A student teaching component has been identified in the earliest formal teacher education curriculum in this country (Byler & Byler, 1984; Cruickshank & Armaline, 1986). In a highly publicized study of teacher education, Conant (1963) found that a field experience was "the one indisputably essential element in professional education" (p. 142).

Follow-up studies in agricultural education have indicated that former students highly value the student teaching experience (Crowder, 1979; Miller, 1974; Orthel, 1979). Marvin (1982) revealed quite clearly the importance of student teaching in the agricultural education preservice program when he stated that student teaching is "universally accepted as the most important part of the professional education of teachers" (p. 161).

Cooperating teachers play a critical role in the development of the abilities and attitudes of preservice students (Byler & Byler, 1984; Chiu, 1975; Haines, 1960; Hedges, 1989; Karmos & Jacko, 1977; Mahan & Lacefield, 1978; Seperson & Joyce, 1973; Yee, 1969; Zevin, 1974). At least three national reports have advocated a greater degree of involvement from practicing teachers in the field for the improvement of teacher education (National Commission for Excellence in Teacher Education, 1985; The Holmes Group, 1986; The Carnegie Task Force on Teaching as a Profession, 1986). A recommendation offered by Cruickshank (1985) for improving the student teaching experience is for individuals involved in teacher education to obtain consensus regarding the evaluation of student teachers.

The validity of Likert-type cooperating teacher summative evaluation instruments has been questioned in terms of halo and leniency effects. Halo effect is subjective rating error associated with raters who are highly influenced by a single behavior or trait (Phelps, Schmitz, & Boatright, 1986).

Researchers have found that cooperating teachers often evaluate student teachers based upon an overall impression as opposed to specific competencies (Wheeler & Knoop, 1982). Others have identified factors such as student teacher preparation and their quality of presentation (Hattie, Olphert, & Cole, 1982) and student teacher self-confidence and their expertise in the instructional process (Phelps et al., 1986) as examples of the halo effect.

Leniency is another subjective rating error associated with evaluations utilizing rating scales (Anastasi, 1982). Leniency refers to a cooperating teacher's inclination to assign consistently satisfactory ratings (Phelps et al., 1986). Allison (1978) and Phelps et al. (1986) revealed that when Likert-type instruments were utilized, cooperating teachers exhibited leniency error.

PURPOSE AND OBJECTIVES

The purpose of this study was to determine the various components identified by the cooperating teacher summative evaluation instrument. Furthermore, this study sought to determine the relationship between the summative evaluation of student teachers (administered by cooperating teachers) and final grade in Student Teaching (assigned by teacher educators). Finally, this study sought to determine the extent to which final grade in Student Teaching could be determined based upon the summative evaluation of student teachers.

Specific objectives of the study were to:

1. Determine the underlying components identified by the summative evaluation instrument used by cooperating teachers in Ohio.

2. Examine the relationship between grade in Student Teaching (as determined by teacher educators) and the summative evaluation of student teachers by their respective cooperating teachers.

3. Determine the amount of variance in final Student Teaching grade that could be explained by summative evaluations of cooperating teachers.

PROCEDURES

Population and Sample

The population for this study was all agricultural education graduates who completed Student Teaching at The Ohio State University between Winter Quarter, 1980 and Winter Quarter, 1986 (N = 283). The composition of the sample included 160 purposefully selected graduates chosen upon their degree of coursework completed at The Ohio State University and availability of summative ratings by their cooperating teachers. A number of transfer students who had taken several courses in the professional education component of the curriculum at other universities were excluded from the study.

Design of the Study

This was a descriptive-correlational study.

Instrumentation

The "Inventory of Student Teacher Traits" was completed by cooperating teachers as a summative evaluation of their respective student teachers. Based upon the components of the instrument (discussed below), reliability of Performance Ratings resulted in a Cronbach's alpha reliability coefficient of $\underline{r}$ = .95, and reliability of Quality Ratings resulted in a Cronbach's alpha reliability coefficient of $\underline{r}$ = .73.

Data Collection

Data concerning student performance were obtained from transcripts and other official documents located in the departmental office.

Data Analysis

Descriptive statistics were used to summarize and analyze the data. Principal components analysis using an oblique rotation method was used to determine latent variables in the 14-item "Inventory of Student Teacher Traits." Relationships were examined using Pearson product-moment correlation coefficients. Multiple linear regression analysis was used to determine the extent to which cooperating teacher summative evaluations influenced grade in Student Teaching.

RESULTS

Underlying Components of Summative Evaluation Completed by Cooperating Teachers

Table 1 shows that student teachers received highest ratings on attendance (X = 8.36, SD = 1.22), safety (X = 8.15, SD = 0.86), and response to authority (X = 8.07, SD = 1.09). Students received the lowest rating in their knowledge of work (X = 7.52, SD = 1.18). The distribution of all 14 traits was negatively skewed.

Components analysis facilitated the transformation of the set of observed variables (14 items on the "Inventory of Student Teacher Traits") into a new set of variables, without assuming the existence of a hypothetical causal model (Ford, MacCallum, & Tait, 1986; Hair, Anderson, & Tatham, 1987).

Two factors emerged as underlying components of the "Inventory of Student Teacher Traits" (Table 2). The ten items loading on the first component identified as Performance Rating included: (1) attitude; (2) cooperation; (3) initiative; (4) dependability; (5) response to authority; (6) work habits; (7) judgment; (8) quantity/speed of work; (9) knowledge of work; and (10) prospect as a teacher.

The four items loading on the second component identified as Quality Rating included: (1) neatness and orderliness; (2) safety; (3) quality of work; and (4) attendance.

Table 1

Cooperating Teacher Summative Evaluations of Student Teachers * (n = 160)

Trait	Mean	Standard Deviation	Range
Attitude	7.78	1.19	3 - 9
Cooperation	7.99	1.15	4 - 9
Attendance	8.36	1.22	1 - 9
Initiative	7.73	1.17	3 - 9
Dependability	7.97	1.25	2 - 9
Response to Authority	8.07	1.09	2 - 9
Work Habits	7.86	1.21	2 - 9
Judgment	7.61	1.22	3 - 9
Neatness/Orderliness	7.93	1.06	4 - 9
Safety	8.15	0.86	4 - 9
Quality of Work	7.82	0.94	5 - 9
Quantity/Speed of Work	7.61	1.05	4 - 9
Knowledge of Work	7.52	1.18	3 - 9
Prospect as Teacher	7.77	1.31	3 - 9

(* Based upon a 9-point Likert-type scale where 1 = poor performance and 9 = superior performance)

As indicated in Table 3, student teachers received slightly higher Quality Ratings (X = 8.06, SD = .76) when compared to Performance Ratings (X = 7.79, SD = .98).

The Bartlett method (Norusis, 1988) was utilized to quantify the data into two true component scores (identified as Performance and Quality Ratings) for subsequent analysis.

Relationships Between Grade in Student Teaching and Summative Evaluation by Cooperating Teachers

Teacher educators have the responsibility of assigning the final grade in Student Teaching. Final grades are based upon personal observations of student teachers by cooperating teachers, assigned work, and cooperating teacher input. Table 4 shows a summary of grades received in Student Teaching.

Table 2

Rotated Component Pattern Matrix of Loading Order of Fourteen Student Teacher Traits

	Oblique Rotation of Components	
Trait	1	2
Initiative	(.91867)	.10722
Prospect as a Teacher	(.90172)	-.05950
Cooperation	(.87805)	-.09261
Judgment	(.84774)	.00291
Attitude	(.83675)	-.02521
Response to Authority	(.81833)	.02983
Work Habits	(.80727)	.10634
Quantity/Speed of Work	(.69090)	.19022
Dependability	(.60846)	.33862
Knowledge of Work	(.54414)	.27991
Safety	-.15226	(.90816)
Neatness/Orderliness	.13044	(.64932)
Quality of Work	.34282	(.58043)
Attendance	.24727	(.46429)

Table 3

Principal Components Analysis Summary for Cooperating Teacher Summative Evaluations (Oblique Rotation Method)

Factor	X	SD	# of Items	Eigen Value	% of Variance
Performance Rating	7.79	.98	10	8.21	58.6
Quality Rating	8.06	.76	4	1.08	7.7

Student Teaching was a 15-quarter-hour course completed by preservice students during their senior years. Three grades were assigned by teacher educators for the 15 hours of credit. The three grades were combined for analysis purposes in order to come up with a final Student Teaching grade.

Of the 160 preservice teachers in the study, the grades ranged from C to A. The average grade was B+ (X = 3.42). The distribution was negatively skewed.

Table 4

Grades in Student Teaching (n = 160)

Grade	Value	Frequency	Percent
A	4.0	9	5.6
A-	3.7	19	11.7
B+	3.3	88	55.1
B	3.0	32	20.1
B-	2.7	7	4.4
C+	2.3	3	1.9
C	2.0	2	1.2
Total		160	100

X = 3.42
SD = .37

As revealed in Table 5, the analysis showed a positive substantial association (Davis, 1971) between Performance Rating and Student Teaching grade (*r* = .62), compared with a positive moderate relationship between Quality Rating and Student Teaching grade (*r* = .36). Student Teaching grade as assigned by teacher educators increased as both Performance Rating and Quality Rating from cooperating teachers increased.

Table 5

Relationships Between Student Teaching Grade and Ratings by Cooperating Teacher (n = 160)

	*r**
Performance Rating	.62
Quality Rating	.36

* = Pearson product-moment correlation

Extent to Which Summative Evaluations of Student Teachers Accounted for Final Student Teaching Grade

As indicated in Table 6, simultaneous entry multiple linear regression was utilized to determine the amount of variance explained in Student Teaching grade by the linear combination of Performance Rating and Quality Rating. Forty-eight percent of the variance in Student Teaching grade was accounted for by the cooperating teacher ratings. A statistically significant proportion of the variance in final Student Teaching grade was explained by Performance and Quality ratings by cooperating teachers ($F = 71.87$, $p < .001$).

In terms of the Performance Rating, the partial regression coefficient was statistically significant ($b = .26$, $t = 12.00$, $p < .001$). Performance Rating contributed to the regression equation when Quality Rating was held constant. The Quality Rating partial regression coefficient was not statistically significant ($b = .02$, $t = .58$, $p = .57$), indicating that the Quality Rating contributed only slightly to Student Teaching grade when Performance Rating was held constant.

Although a positive substantial relationship was found between Student Teaching grade and Performance Rating, and a positive moderate relationship was found between Student Teaching grade and Quality Rating by cooperating teachers, only Performance Rating was found to explain a significant proportion of the variance in Student Teaching grade.

Table 6

Regression of Student Teaching Grade on Cooperating Teacher Ratings (n = 160) (Simultaneous Entry)

	R2	R2 *Change*	*b*	*t*	*p*
Performance Rating	.48	.48	.26	12.00	.001
Quality Rating	.48	.001	.02	.58	.57
(Constant)			3.42	159.37	.001

Standard error = .27
Adjusted R2 = .47
$F = 71.87$, $p < .001$

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Cooperating teachers perceived that the student teachers attended regularly, were conscientious about learning, and were well-versed in the safety aspects associated with teaching secondary agricultural education. However, cooperating teachers held the perception that student teachers did not have a clear understanding of the complexity of teaching secondary agricultural education. Pfister and Newcomb (1984) warned that cooperating teacher expectations of student teachers were unrealistic and were inconsistent when compared to expectations which teacher educators held for student teachers.

Of the 14 traits listed on the summative evaluation instrument, cooperating teachers tended to rate student teachers high on all items. Such high ratings tend to support similar findings regarding leniency error (Allison, 1978; Phelps et al., 1986). Cooperating teachers might be experiencing difficulty in distinguishing differences in various levels of student teacher performance.

Two underlying components were identified in the "Inventory of Student Teacher Traits." The two components were Performance Rating (consisting of ten traits) and Quality Rating (consisting of four traits). The identification of only two components tends to support findings of others (Hattie et al., 1982; Phelps et al., 1986) that a possible halo effect exists. Cooperating teachers may be evaluating student teachers based upon an overall impression as opposed to specific traits.

Although Student Teaching grade was substantially associated with Performance Rating, and moderately associated with Quality Rating, only Performance Rating was found to explain a significant proportion of the variance in Student Teaching grade. Collectively, summative Performance and Quality Ratings by the cooperating teachers were useful in determining almost half of the variance accounted for in Student Teaching grade assigned by the teacher educators.

Specifically, the following traits identified by cooperating teachers accounted for almost all of the variance in final Student Teaching grade: (1) attitude; (2) cooperation; (3) initiative; (4) dependability; (5) response to authority; (6) judgment; (7) quantity/speed of work; (8) knowledge of work; (9) work habits; and (10) prospect as a teacher.

Recommendations

Research is needed to address the concern regarding cooperating teacher perceptions that student teachers do not have a clear understanding of the complexity of teaching secondary agricultural education. Teacher educators and cooperating teachers should come to agreement regarding realistic student teacher behaviors.

Teacher educators need to provide intensive inservice education classes for cooperating teachers on how best to distinguish differences in student teacher performance. Such classes should make use of case studies where cooperating teachers practice evaluating the behavior of student teachers for the purpose of establishing inter-rater reliability of cooperating teacher ratings.

The instrument utilized by the cooperating teachers when evaluating student teacher traits should be examined more closely in terms of the content validity of the instrument. Specific constructs linked to important teacher behaviors should be reviewed and the instrument should be revised accordingly.

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MORALE LEVELS OF FIRST-YEAR AGRICULTURAL EDUCATION TEACHERS

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Morale can be defined as the professional interest and enthusiasm a person displays towards the achievement of individual and group goals in a given job situation (Bentley & Rempel, 1980). Morale is set within the framework of organizational theory with an individual progressing toward the achievement of organizational tasks and his or her perceived job satisfaction within the total organization. Morale is a continuous variable that measures an individual's perception of task achievement and job satisfaction. High morale can be characterized by interest and enthusiasm for the job. While low morale is characterized by feelings of dissatisfaction and frustration. Teacher morale can be viewed as teachers striving to achieve their individual goals and the educational goals of the school system and their perceptions of satisfaction that stem from the total school environment.

The morale of agricultural education teachers has been an area of investigation for several years. Experienced agricultural education teachers have higher levels of morale or job satisfaction when compared with beginning agricultural education teachers (Grady, 1985; Debertin & Priebe, 1984). When compared with national morale norms for junior and senior high faculties, beginning agricultural education teachers rank consistently below the 50th percentile (Flowers & Pepple, 1988). Few studies have examined the morale levels for a group of beginning agricultural education teachers over an extended period of time or the relationship between morale level and job turnover. Beginning teachers are in an especially vulnerable position during their few years of teaching (Craig, 1983; Knight, 1978). Achieving individual educational goals and feelings of satisfaction are critical factors as young teachers decide whether to remain in or to leave the teaching profession. By understanding the nature of morale and the relationship between morale and job turnover, educators can assist young teachers in developing effective strategies for maintaining high morale levels.

PURPOSE AND OBJECTIVES

The main purpose of this study was to measure the morale level of first-year agricultural education teachers. The specific objectives of the study were:

1. to determine the morale level of first-year agricultural education teachers as measured by the Purdue Teacher Opinionaire (PTO),

2. to compare the morale level of first-year agricultural education teachers with national PTO norms for secondary school teachers,
3. to determine if differences exist among first-year, second-year and fifth-year measures of morale for a given group of teachers, and
4. to determine the relationship between levels of first-year teacher morale and job turnover rates.

METHODS

For purposes of this study, first-year teachers were defined as teachers who have received a B.S. degree in agricultural education from a four-year university, who have obtained a four-year provisional teaching certificate, and are enrolled in a graduate-level first-year teacher program. The target population was all first-year secondary agricultural education teachers meeting these criteria during the 1985-86 to 1989-90 school years. A census study was conducted with the 56 teachers identified during the five-year period. Fifteen teachers were included in the 1985-86 school year, 11 teachers in 1986-87, eight teachers in 1987-88, 11 teachers in 1988-89, and 11 teachers in 1989-90.

The Purdue Teacher Opinionaire (PTO) was used to measure teacher morale. The PTO consists of 100 items that ask teachers to make qualitative judgments about their teaching environment. The 100 items are divided into 10 factors that measure the multidimensional nature of morale: Teacher Rapport with Principal, Satisfaction with Teaching, Rapport Among Teachers, Teacher Salary, Teacher Load, Curriculum Issues, Teacher Status, Community Support of Education, School Facilities and Facilities and Services, and Community Pressures.

Test-retest data have been obtained from 3,023 teachers. Correlation coefficients range from .62 to .88 for the 10 factors and .87 for the overall instrument. Content validity was established by a large sample of high school facilities (n = 174). The Opinionaire has been found to discriminate among different schools and among individual teachers in a particular school.

Item responses are weighted for scoring by a four-point scale with 4 = agree, 3 = probably agree, 2 = probably disagree, and 1 = disagree. Reversing the weights for negative items results in a score of 4.0 representing high morale and 1.0 representing low morale. The calculated means for the 10 subfactors were interpreted according to the national PTO norms for junior and senior high school teachers using the following scale:

High Morale - Above the 75th percentile.
Moderately High Morale - Between the 50th and 75th percentiles
Moderately Low Morale - Between the 10th and 50th percentiles
Low Morale - Below the 10th percentile

The Opinionaire was administered by the researchers to the first-year teachers in October of each year during a first-year teacher seminar. For those teachers not attending the seminar, the PTO was mailed with a self-addressed stamped evelope. A 100% response rate was obtained for the 56 teachers in the study. Job turnover data were obtained from state department of education records.

An overall morale score was calculated for the 56 teacher in addition to mean scores for the 10 factors. Overall and factor means were intrepreted by noting their defined position on the percentile scale. First-year, second-year, and fifth-year mean factor scores for a given group of teachers were compared for any visible differences. A correlation coefficient was calculated to measure the relationship between overall teacher morale and job turnover rate.

RESULTS

The overall morale score for the 56 teachers was 3.01, indicating a moderately low level of morale. Overall morale levels were similar for the 56 teachers during the five-year data collection period. Morale scores also were calculated for the 10 factors for the 56 teachers. Figure 1 compares the first-year teachers with the national norm group at the 50th percentile. High morale levels were expressed for two of the factors: teacher salary and community support. Moderately high morale levels were indicated for teacher status and curriculum issues. Moderately low morale levels were expressed for rapport with principal, rapport among teachers, and school facilities. Low morale levels were expressed for satisfaction with teaching, teacher load, and community pressures. Although satisfaction with teaching received the highest mean score ($\overline{X} = 3.20$) for the 56 first-year teachers, the mean was still below the 10th percentile of the norm group. First-year, second-year, and fifth-year morale scores were calculated for a selected group of teachers. Overall mean scores were similar for the three measures ($\overline{X} = 3.02$, $\overline{X} = 2.89$, $\overline{X} = 2.87$). As illustrated in Figure 2, for those teachers who remained in the profession, the mean scores for satisfaction with teaching increased for the first, second, and fifth year measures. There was a slight decrease in mean morale scores for the remaining nine factors. A positive low relationship ($r = .13$) was found overall morale score and job turnover rate. When considering individual factors, a positive, moderate association was found between job turnover and teacher salary ($r = .39$).

CONCLUSIONS AND IMPLICATIONS

The 56 first-year agricultural education teachers have moderately low levels of morale. When compared with another group of first-year agricultural education teachers (i.e., Flowers/Pepple study), the Ohio teachers have slightly higher morale scores. However, when compared with national norms, the first-year teachers rank consistently below the 50th percentile for the majority of the morale factors. Repeated measures of morale are similar for teachers remaining in the teaching profession. In other words, morale levels do not necessarily increase as teachers remain in the profession.

Teacher educators should note the factors that received low morale socres. First-year teachers may need additional assistance in dealing with community pressures and teacher load concerns. When supervising first-year teachers, teacher educators need to highlight the unique aspects of teaching agriculture that may encourage low morale levels. Coping with inadequate school facilities, adjusting to a heavy teaching load, getting along with other teachers and the principal, and handling community pressures are areas that may need to be addressed in the preservice preparation and inservice programs for first-year teachers.

Figure 1
Comparative Mean PTO Scores for First-Year Teachers

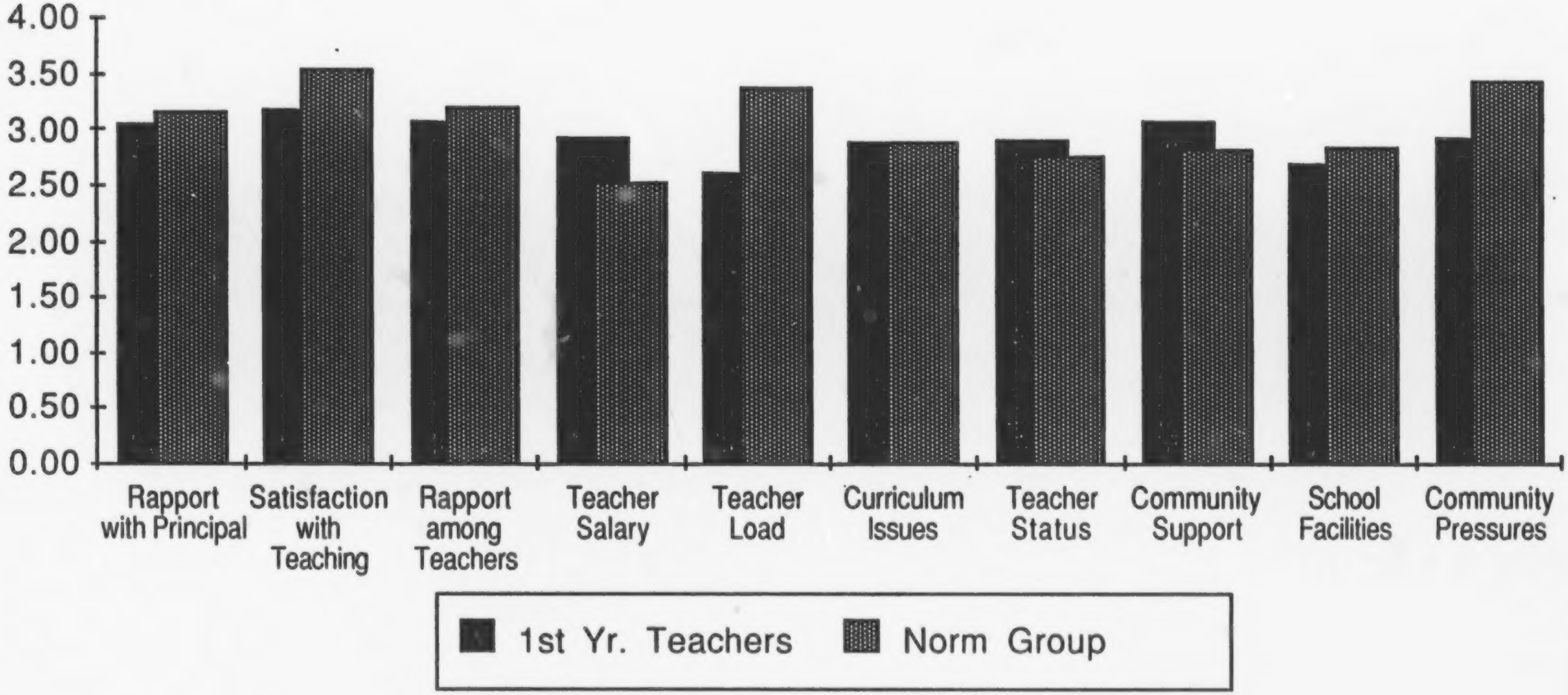
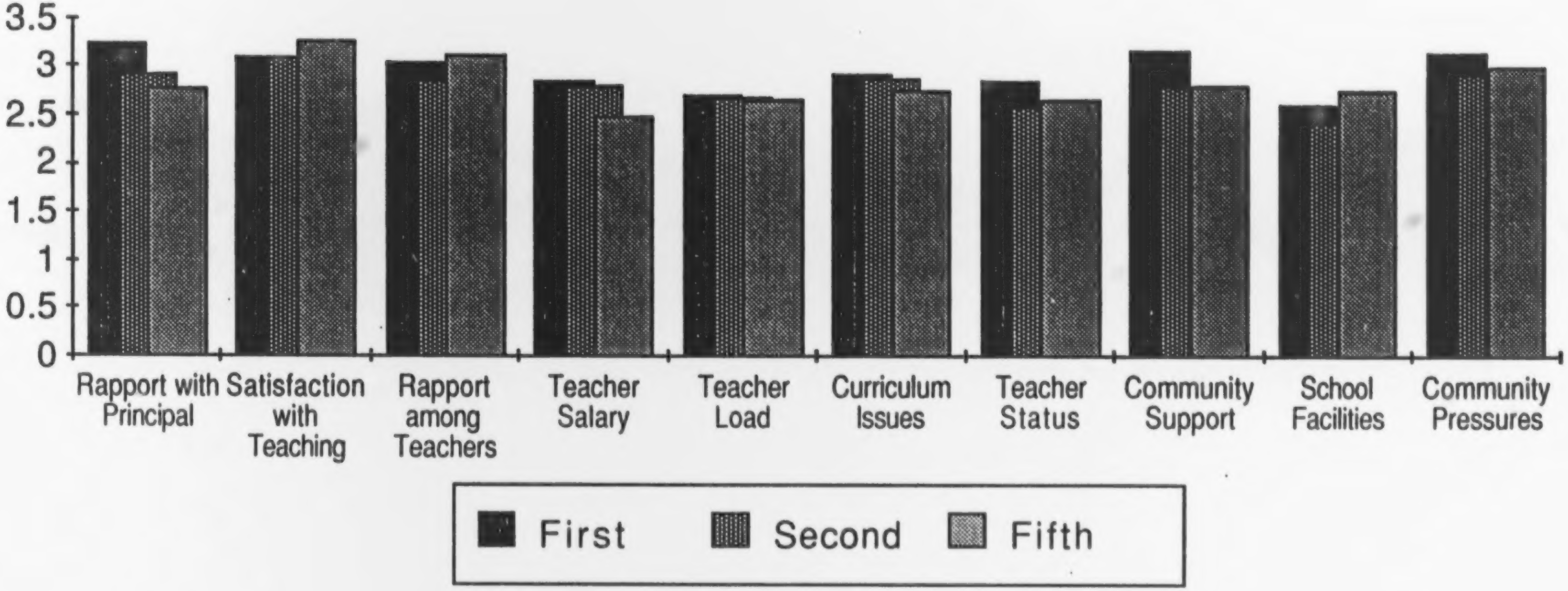


Figure 2
First, Second, and Fifth Year Measures of Morale for Agricultural Teachers in Ohio



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VOCATIONAL-TECHNICAL FACULTY EFFICACY: ITS RELATIONSHIPS AND IMPLICATIONS

A CRITIQUE

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This paper addressed an important concern of many in agriculture and education. It is particularly important to those interested in faculty development and teacher retention. It seems that this topic has strong implications for inservice education in teacher education. The paper presented many practical and some surprising implications for professional development in agricultural education.

There are many strengths of this paper. The researchers are to be commended for identifying an area, doing a thorough review of literature, and developing a theoretical framework for the study. The methodology and the statistical analysis seems appropriate. A finding in the study that warrants further study is the number of professional development activities that were negatively related to self-efficacy. As pointed out in the paper, this finding was a surprise in the study.

A few questions and concerns related to the study are as follows:

1. The problem statement is not clear and seems to need a little more development. It is not clear what the problem is until one reads the objectives.

2. The researchers reported that there was a 74 percent return of the questionnaires. It was not clear who collected the instruments and there appeared to be no follow-up on the non-respondents.

3. The results, findings, conclusions, and implications were at times confusing. There appeared to be some discussion of data that was not reported in the body of the paper. Perhaps this paper was reporting on one section of a larger study. Specifically, mention was made of administrative self-efficacy but was apparently not supported by data in the paper.

4. It would have been helpful for the paper to have included a discussion of practical significance along with the statistical significance.

In conclusion, the researchers are to be commended for exploring an area that is very important to inservice education and the retention of teachers in vocational-technical education. This is an area that warrants further research, especially in the area of faculty development as it relates to self-efficacy

THE ASSOCIATION BETWEEN COOPERATING TEACHER AND TEACHER EDUCATOR EVALUATIONS OF STUDENT TEACHING PERFORMANCE

A CRITIQUE

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The grading of student teachers by cooperating teachers and teacher educators continues to be a problem for the profession. The researchers are to be commended for looking into the grading procedures of student teachers as this is an issue that often causes considerable concern and, in some programs, has led to pass/fail grading. The introductory section of the paper included a thorough review of literature. The purpose and objective were clearly stated. The composition of the sample included 160 purposefully selected graduates completing student teaching in Ohio. Descriptive statistics were used to analyze the data.

The following questions and concerns were raised:

1. It was not clear to the reader how student teaching grades were determined. What official documents were used? Did teacher educators evaluate the student teachers during the quarter? If so, how were their grades used in assigning the final grade?

2. It was stated that final grades were determined based upon personal observations, assigned work, and cooperating teacher input. These grading criteria should have been explained for the reader.

3. Did teacher educators evaluate student teachers with the same instrument? If they did, why were they not analyzed?

The discussion section may be more complex than the data of the study can support.

The researchers should be commended for their efforts in researching an important area in student teaching. The recommendations seem appropriate for the study.

MORALE LEVELS OF FIRST-YEAR AGRICULTURAL EDUCATION TEACHERS

A CRITIQUE

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The researchers are to be commended for identifying an important topic to the profession. Morale is a concern for teacher educators working with beginning teachers. The purpose and objectives of the study were clearly stated. The Purdue Teacher Opinionnaire was used to measure teacher morale and the review of literature documented the appropriateness of the instrument. The statistical analyses seem appropriate for the study.

Some concerns of the study are as follows:

1. It was reported that morale was higher for second and fifth year teachers; however, the reported means indicated that morale for second year teachers was slightly lower.

2. Correlations were reported for morale score and job turnover rate, job turnover and salary; but was not reported for the other nine factors. It would have been helpful to the reader to have reported these and to have reported data on job turnover. What does a positive correlation between job turnover and salary mean?

3. In the conclusions and implications section, it was reported that first year teachers need additional assistance in dealing with inadequate school facilities, adjusting to a heavy teaching load, getting along with other teachers and the principal, and handling community pressures. It would appear from the tables that second and fifth year teachers are lower in most of these categories than first year teachers. Therefore, they need help as well.

4. When considering individual factors, a positive, moderate association was reported between job turnover and teacher salary. This area needs further explanation.

5. It was not clear how the second and fifth year teachers were measured. How were those who quit teaching at the end of the first year treated? If one assumes that those who quit had low morale, then the remaining second and fifth year teachers had considerably lower morale than the first year teacher.

This is an interesting study. It would appear, however, that the body of the paper should be expanded to include more tables so the reader can follow the interpretations. It would be helpful for the data from the comparison study to be reported (Flowers/Pepple study) to document the conclusion and implications of the study. Since the paper was very short (six pages), there would have been adequate space to develop the paper further.

AN ASSESSMENT OF THE LEVEL OF COGNITIVE PERFORMANCE AND CRITICAL THINKING ABILITY OF SELECTED VOCATIONAL AGRICULTURE STUDENTS

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INTRODUCTION

Agricultural educators and students are constantly facing a growing body of complex information, knowledge, and skills. The sheer amount of information, knowledge, and skills needed by agriculture students to function in today's society is overwhelming. The high rate of technological change that is associated with an information society demands that students possess the ability to process increasing amounts of complex information and knowledge in practical and systematic ways.

Moreover, the rate of growth of the information, knowledge and skills needed by agriculture students is so rapid that many students risk becoming agriculturally obsolete unless they continually learn and update themselves, both in and out of a formal educational setting. However, it is not known to what extent vocational agriculture students are able to process the increasing amounts of information, knowledge, and skills.

In recent reports advocating educational reform (Adler, 1982; Boyer, 1983; Goodlad, 1984; National commission on Excellence in Education, 1983) most of the recommendations forwarded were aimed at students. The quality and the quantity of instruction the students received was generally found wanting. Among the concerns identified by the educational reports was the lack of skills which students need to be able to properly cope with everyday life situations. The reports conclude that students do not graduate adept at problem solving, critical thinking, or higher order thinking.

Many educators and researchers argue that the development of problem solving abilities to enhance critical thinking and higher order thinking to solve everyday life situations is probably the single most important basic skill that can be learned (Cowan & Clary, 1978; McTighe & Schollenberger, 1985; Tobin & Capie, 1980; Arter & Salmon, 1987). Yet a dearth of research exists on the cognitive and critical thinking abilities of vocational agriculture students.

The problem solving approach to teaching has been on of the cornerstones of vocational agriculture instruction. Although vocational agriculture instructors are familiar with and may use the problem solving technique, are agriculture students actually capable of critically thinking through problem situations? Furthermore, do agricultural students think at higher levels of cognition to solve problems?

PURPOSE AND OBJECTIVES

The purpose of this study was to determine the extent to which students in vocational agriculture programs were performing at the various levels of cognition utilizing Bloom's Taxonomy. In addition, this study sought to determine the extent to which vocational agriculture students

The following research questions were investigated:

1. What was the cognitive level of performance of vocational agriculture students as measured by the Developing Cognitive Abilities Test (DCAT)?

2. What was the critical thinking ability of vocational agriculture students as measured by the Watson-Glaser Critical Thinking Appraisal?

3. What was the extent to which the cognitive level of performance by the students differed among the grade levels (ninth, tenth, eleventh, and twelfth)?

4. What was the extent to which the critical thinking level of the students differed among grade levels (ninth, tenth, eleventh, and twelfth)?

PROCEDURES

Population and Sample

The population for this study was the students enrolled in vocational agriculture classes in Ohio during 1988-89. Ten schools were purposefully selected for this study based upon predetermined criteria. All students enrolled in vocational agriculture at the selected schools (n=384) took the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal. Because the schools were purposefully selected, the findings of this study may not be generalized beyond the population in the current study.

Design of Study

This was a descriptive study.

Instrumentation

The Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal were administered to vocational agriculture students enrolled in vocational agriculture programs at the selected schools. Validity and reliability have been established for both standardized tests which were utilized to collect the data by their respective authors.

Data Collection

The Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal were mailed to each vocational agriculture instructor at each selected school for administration. Each respective test was accompanied by specific instructions for test administration. In addition, the teachers were asked to complete a test administration form for each test to ensure compliance to the directions.

DATA ANALYSIS

All data were analyzed using the Statistical Package for the Social Sciences, Personal Computerversion (SPSS^{x}PC). Descriptive statistics were used to determine student cognitive level of performance and critical thinking abilities. Differences among grade levels within the cognitive levels of performance and critical thinking ability were determined using analysis of variance.

RESULTS

Developing Cognitive Abilities Subtests

The Developing Cognitive Abilities Test subtests are based on the levels of Bloom's (1956) Taxonomy, which are hierarchical in nature. Results indicated that students scored higher on questions based on the lower levels of Bloom's Cognitive Domain (Table 1), with scores ranging as follows: 67% correct at Basic level (knowledge/comprehension levels of Bloom's Taxonomy), 59% correct at Application level (application level of Bloom's Taxonomy), and 48% correct at Critical Thinking level (analysis/synthesis levels of Bloom's Taxonomy). The overall mean score for the Developing Cognitive Abilities Test was 58%.

Table 1

Mean Percent Correct for All Students on Cognitive Subtests of the Developing Cognitive Abilities Test
(n=384)

Subtest	Percent
Basic	67%
Application	59%
Critical Thinking	48%
DCAT Overall	58%

Watson-Glaser Critical Thinking Abilities Subtests

The Watson-Glaser Critical Thinking Abilities Appraisal, unlike the Developing Cognitive Abilities Test, is not based upon a hierarchical model. The mean scores of students on the various subtests of the Watson-Glaser Critical Thinking Appraisal are presented in Table 2. With the exception of Inference, the mean scores did not vary much among the subtest scores. For each subtest, the following mean scores were obtained: Inference, 38%; Recognition of Assumptions, 63%; Deduction, 56%; Interpretation, 56%; and Evaluation of Arguments, 56%. The overall mean score for the Watson-Glaser test was 53%.

Table 2

Mean Percent Correct for All Students on Subtests of the Watson-Glaser Critical Thinking Appraisal
(n=384)

Subtest	Percent
Inference	38%
Recognition of Assumptions	63%
Deduction	56%
Interpretation	56%
Argument	56%
Watson-Glaser Overall	53%

Differences Among Grade Levels on Subtests of the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal

Using one-way analysis of variance, significant differences were found in the test scores in the Developing Cognitive Abilities Test among the grade levels. For the measure at the Application level of the DCAT, significant differences among scores were noted between ninth-grade students and twelfth-grade students (Table 3). Significant differences were also noted among total Developing Cognitive Abilities Test scores (Table 3) between ninth-grade students and twelfth-grade students. Student performance on the Watson-Glaser Critical Thinking Appraisal revealed no significant differences among the grade levels (Table 4).

Table 3

Analysis of Variance for the Developing Cognitive Abilities Subtests by Grade Level

Subtest Score	Mean Score by Grade Level					
	9	10	11	12	F	Prob.
Basic	17.17a	18.23a	17.32a	18.14a	1.72	.163
Application	14.88a	16.35ab	16.31ab	17.01b	4.06	.007
Critical Thinking	11.94a	12.91a	13.09a	13.58a	2.15	.094
DCAT Total	43.81a	47.45ab	46.81ab	48.71b	3.06	.028

Note: Means with the same subscript do not differ significantly.

Table 4

Analysis of Variance for Watson-Glaser Subtests by Grade Level

Subtest Score	Mean Score by Grade Level					
	9	10	11	12	F	Prob.
Inference	5.71a	5.69a	5.75a	6.34a	1.28	.282
Recognition of Assumptions	9.02a	9.44a	9.61a	10.07a	1.94	.123
Deductions	8.95a	8.68a	8.75a	9.14a	0.65	.585
Interpretations	8.89a	9.33a	8.77a	8.60a	1.25	.290
Artuments .	9.14a	9.22a	8.75a	9.65a	1.47	.222
Watson-Glaser Total	41.73a	42.27a	41.66a	43.85a	1.22	.301

Note: Means with the same subscript did not differ significantly.

CONSLUSIONS AND IMPLICATIONS

The findings of this study support the findings of previous studies (Newcomb & Trefz, 1987; Cano, 1988; Pickford, 1988; Rollins, Miller, & Kahler, 1988). Students of agriculture tend to score at higher percentages than students in other disciplines such as science (Billeh, 1974), English (Purves, 1971), and social studies (Hunkins, 1969) at the higher levels of cognition. Although agricultural educators profess that problem solving instruction is the cornerstone of agricultural instruction, is the problem solving approach to teaching the variable which increases the agricultural students' cognitive ability? Further research is recommended to answer the aforementioned question.

In regards to critical thinking abilities of agricultural students, the research basis is shallow. Rollins, Miller, and Kahler (1988) concluded that agriculture students were able to think critically through problem situations using another form of measurement. Utilizing the Watson-Glaser Critical Thinking Appraisal, the findings support the conclusion that agriculture students are able to think critically at the various levels (measured by percent correct). Again, is the problem solving approach to teaching the catalyst which serves to increase the agriculture students' critical thinking ability? Further research is recommended to determine if the problem solving approach to teaching is the catalyst which influences agriculture students to think critically.

It was concluded by the current study that ninth-grade students scores significantly different than twelfth-grade students on the Developing Cognitive Abilities Test. This finding is supported by research which was conducted by Cano (1988). However, there was not a significant difference in the critical thinking abilities of the high school students among grade levels. Why not? Could it be concluded that students reach their critical thinking ability level prior to the ninth-grade? Further research is necessary to determine why the critical thinking ability of agriculture students does not significantly increase (as measured by percent correct) as the student progresses to higher grade levels.

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THE RELATIONSHIP BETWEEN CRITICAL THINKING ABILITY AND LEVEL OF COGNITIVE PERFORMANCE OF SELECTED VOCATIONAL AGRICULTURE STUDENTS

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INTRODUCTION

Previous studies have measured and explained cognitive abilities (Newcomb & Trefz, 1987; Cano, 1988; Pickford, 1988) and explained critical thinking abilities (Rollins, Miller, & Kahler, 1988; Arter & Salmon, 1987; Ennis, 1985). Previous research has indicated that most students show little evidence of using critical thinking skills when solving problems; most, in fact, continue to operate in a concrete operational manner (Day, 1981).

Furthermore, cognitive deficiencies that characterize poor problem solvers have been identified by researchers, with a passive approach to learning identified as an underlying causal factor (Chance, 1981; Lochhead, 1981). Fuerestein (1980) and Jensen (1969, 1973) believed that human intellectual capacities were not determined entirely by heredity; rather, that cognitive development could be positively influenced. They believed that the problem solving approach to teaching was, perhaps, one means of influencing cognitive development.

One of the cornerstones of vocational agriculture instruction has been the problem solving approach to teaching. While instructors of vocational agriculture are familiar with and may use the problem solving technique, are agriculture students actually capable of critically thinking through problem situations? Furthermore, do agricultural students think at higher levels of cognition to solve problems? In addition, does a relationship exist between cognitive abilities and critical thinking abilities of vocational agriculture students?

PURPOSE AND OBJECTIVES

The purpose of this study was to determine the extent to which students enrolled in vocational agriculture programs were performing at the various levels of cognition utilizing Bloom's Taxonomy. Further, this study sought to determine the extent to which vocational agriculture students think critically. In addition, this study sought to determine the relationship between level of cognitive performance and critical thinking ability.

The research questions investigated were:

1. What was the cognitive level of performance of students in vocational agriculture programs as measured by the Developing Cognitive Abilities Test (DCAT)?

2. What was the critical thinking ability of students in vocational agriculture programs as measured by the Watson-Glaser Critical Thinking Appraisal?

3. That was the relationship between the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal scores of student in vocational agriculture programs?

PROCEDURES

Population and Sample

The population for this study was comprised of students in Ohio who enrolled in vocational agriculture classes during 1988-89. Ten schools were purposefully selected for the study based upon predetermined criteria. All students enrolled in vocational agriculture classes at the selected schools (n=384) were administered the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal.

Design of Study

This was a descriptive-correlational study.

Instrumentation

The Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal were administered to all students enrolled in vocational agriculture classes at the selected schools. Validity and reliability for both standardized tests utilized to collect the data have been established by their respective authors.

Data Collection

The vocational agriculture instructor at each selected school was mailed for administration, the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal. Each respective test was accompanied by specific instructions for test administration. In addition, each instructor was asked to complete a test administration form for each test to ensure compliance to directions.

ANALYSIS OF DATA

Descriptive statistics were used to determine the cognitive level of performance and critical thinking abilities of the students. Canonical correlation was used to describe the relationship between the Developing Cognitive Abilities Test scores and the Watson-Glaser Critical Thinking Appraisal scores.

RESULTS

Developing Cognitive Abilities Subtests by Grade Level

The subtests of the Developing Cognitive Abilities Test are based on the levels of Bloom's (1956) Taxonomy, which are hierarchical in nature. The Basic abilities subtest consists of items classified at the knowl-edge/comprehension level, the Application abilities subtest consists of items classified as application, and the Critical Thinking abilities subtest consists of items classified as analysis/synthesis.

Students at every grade level scored highest on the Basic abilities subtest, lower on the Application abilities, and lowest on the Critical Thinking abilities (Table 1). Tenth grade students scored higher than eleventh grade students on Basic abilities, Application abilities and overall (DCAT Total). Ninth grade students scored consistently lower than students at all other grade levels on all subtests (Table 1) and DCAT Total. Additionally, for the Critical Thinking abilities subtest a linear trend was found (Table 1). As students advanced by grade level, their score on the Critical Thinking abilities subtest also tended to increase.

Table 1

Means of Students for Cognitive Subtests of the Developing Cognitive Abilities Test by Grade Level

		Level of Cognitive Subtest			
Grade Level	n	Basic	Application	Critical Thinking	DCAT Total
9	96	17.17	14.88	11.94	43.81
10	114	18.23	16.35	12.91	47.45
11	88	17.32	16.31	13.09	46.81
12	86	18.14	17.01	13.58	48.71
Total	384	17.73	16.12	12.86	46.67

Watson-Glaser Critical Thinking Appraisal Subtests by Grade Level

Table 2 depicts the mean scores of students across grade levels for the various subtests of the Watson-Glaser Critical Thinking Appraisal. Unlike the subtests for the Developing Cognitive Abilities Test, these subtests are not hierarchical. The lowest scores for all grade levels were reported on the Inference subtest with mean scores ranging from 5.69 to 6.34 based on a maximum score of 16 (Table 2). In addition, twelfth grade students scored consistently higher than their counterparts at other grade levels (Table 2).

Table 2

Means of Students for Subtests of the Watson-Glaser Critical Thinking Appraisal by Grade Level

Grade Level	n	Critical Thinking Subtests Infer.	Assump.	Deduct.	Interp.	Argue.	Total
9	96	5.71	9.02	8.95	8.89	9.14	41.73
10	114	5.69	9.44	8.68	9.33	9.22	42.27
11	88	5.75	9.61	8.75	8.77	8.75	41.66
12	86	6.34	10.07	9.14	8.60	9.65	42.35

Note: Maximum score = 16 per subtest; Total maximum score = 30.

Relationship Between the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal

The canonical correlation procedure was used to calculate the relationship between student performance on the Developing Cognitive Abilities Test and student performance on the Watson-Glaser Critical Thinking Appraisal. The correlation matrix depicting the relationship between the independent (predictor) and dependent (criterion) variables is presented in Table 3.

Among the criterion variable set, substantial positive intercorrelations were found (Davis, 1971). Among the predictor variable set, however, low to moderate positive intercorrelations (Davis, 1971) were found. The correlations between the individual predictor and criterion variables resulted in positive coefficients which ranged from low to moderate (Davis, 1971).

The null hypothesis tested was that all squared canonical correlations ($R^2_{c(s)}$ equaled zero. The Wilks Lambda test of significance for the first canonical function revealed that the test was significant at $p = .01$ (Table 4), therefore the null hypothesis was rejected.

Standardized Canonical and Structure Coefficients

For the independent variables, the standardized canonical weights for covariates revealed betas ranging from -.450 to -.161 with inference and interpretation being relatively most important. The betas for the dependent variables ranged from -.506 to -.227 with critical thinking being relatively most important (Table 5).

Guidelines established by Chuatong (1987) were used to interpret the magnitude of the structure coefficients. The interpretations were: .25 or lower, Low; .25 to .64, Moderate; .65 or higher, High. On the

Table 3

Relationship* Between the Developing Cognitive Abilities Test and the Watson-Glaser Critical Thinking Appraisal

(n=384)

	Criterion Variable Set (Percent Items Correct) Student Level of Performance on the Developing Cognitive Abilities Test			Predictor Variable Set (Percent Items Correct) Student Level of Performance on the Watson-Glaser Critical Thinking Appraisal				
	B	A	C	I	RA	D	In	EA
Criterion Variable Set								
Basic Abilities	1.000							
Application Abilities	.685	1.000						
Critical Thinking Abilities	.656	.686	1.000					
Predictor Variable Set								
Inference	.379	.335	.387	1.000				
Recognition of Assumptions	.266	.215	.267	.271	1.000			
Deduction	.219	.234	.269	.237	.136	1.000		
Interpretation	.375	.362	.362	.332	.133	.354	1.000	
Evaluation of Arguments	.255	.298	.305	.207	.177	.177	.338	1.000

Note: B=Basic; A=Application; C=Critical Thinking; I=Inference; RA=Recognition of Assumptions; D=Deduction; In=Interpretation; EA=Evaluation of Arguments.

*Pearson's Product Moment Correlation Coefficients

Table 4

Canonical Correlation Analysis

Function	Eigen Value	Canonical Correlation	Squared Canonical Correlation	F Test	P
1	.459	.561	.315	10.81	.010
2	.017	.128	.016	1.04	.404
3	.005	.073	.005	0.67	.569

Wilkes Lambda = .671, F = 10.81 (df 15,384), p = .010

dependent variable set, Critical Thinking abilities (-.919) loaded highest on Canonical Variate 1, with Basic abilities (-.879) and Application abilities (-.843) also found to be high (Table 5). For the independent variable set, Inference (-.750) and Interpretation (-.735) loaded highest on Canonical Variate 1 (Table 5).

CONCLUSIONS AND/OR RECOMMENDATIONS

Conclusions

1. A significant relationship existed between student mean scores on the DCAT and student mean scores on the Watson-Glaser Critical Thinking Appraisal.

2. All intercorrelations were low to substantial and positive, indicating that as scores on one test increased, a corresponding increase was found on the other test.

3. Students in the current study were performing at levels comparable to other agriculture students, based on findings from previous studies (Newcomb & Trefz, 1987; Cano, 1988; Pickford, 1988).

4. Compared to finding of previous studies (Gall, 1970; Ryan, 1973), the students performed at higher percentages at the various levels of cognition.

Recommendations

1. Students in vocational agriculture programs should be challenged to develop cognitive abilities and critical thinking abilities at higher levels through the instruction they receive.

2. Further research should be conducted to explore the extent to which the problem solving technique, which has been the cornerstone of vocational agriculture, contributes to the development of students' cognitive ability and critical thinking ability.

Table 5

Summary of Canonical Correlation Analysis

Variable	Canonical Variate 1		Canonical Variate 2		Canonical Variate 3	
	b	s	b	s	b	s
Criterion Variable Set						
Basic Abilities	-.391	-.879	1.364	.419	.375	.229
Application Abilities	-.227	-.843	-1.061	-.353	1.068	.406
Critical Thinking Abilities	-.506	-.919	-.331	-.164	-1.339	-.359
Predictor Variable Set						
Inference	-.450	-.750	.304	.255	-.337	-.247
Recognition of Assumptions	-.271	-.514	.437	.356	-.330	-.371
Deductions	-.161	-.491	-.403	-.298	-.600	-.384
Interpretations	-.409	-.735	.321	.052	.948	.591
Evaluation of Arguments	-.259	-.554	-.886	-.711	.036	.121
Redundancy		.170 $R^2_{c(1)}$=.315		.011 $R^2_{c(2)}$=.016		.003 $R^2_{c(3)}$=.005

Note: b=Standardized Canonical Coefficient; s=Structure Coefficient

3. Further research should be conducted to determine whether results of this study are generalizable for the population of vocational agriculture students.

4. Cognition and critical thinking research should be conducted in other vocational areas.

5. Further research should be conducted which compares performance of vocational agriculture students to that of the student body at large.

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MATHEMATICAL PROBLEM SOLVING COMPETENCE AND RELATED FACTORS OF HIGH SCHOOL VOCATIONAL AGRICULTURE TEACHERS AND STUDENTS

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INTRODUCTION

To the American public, mathematics is generally considered a basic skill for optimum efficiency in social, consumer, economic and occupational endeavors. It follows that courses of study in vocational agriculture must include instruction in both cognitive and manual skills including instruction that enables learners to develop basic competency in computational skills. It is indisputable that those who do not possess basic mathematical skills are disadvantaged, especially when they compete with those who possess these skills.

The extent to which these skills are mastered by vocational education students in secondary schools has rarely been investigated. In fact, several widely disseminated recent reports have questioned the extent to which the schools, including vocational education, are teaching basic skills such as mathematical problem solving. This study helps to provide a data base for examining issues in agricultural education such as how do teachers teach problem solving, teachers' level of competence to solve mathematical problems, and possible reasons students are not high achievers in solving mathematical problems including the ability to reason and conceptualize problems.

OBJECTIVES

This study investigated the mathematical competence of high school vocational agriculture teachers and students on a mathematical problem solving test in agricultural mechanics. The following research questions were investigated.

1. What level of competence in solving mathematical problems do high school vocational agriculture teachers have?
2. What are the relationships between teachers' competence in solving mathematical problems and the following variables: a) final college grade point average; b) the number of college math courses completed; c) the number of college courses completed where the "unit factor method" was utilized as the method for solving problems; d) whether teachers utilized a written, organized procedure in solving problems; e) whether teachers used the "unit factor method" while teaching; f) whether teachers taught the use of the "unit factor method" for solving problems; and g) whether teachers required students to use the "unit factor method" when solving

problems.

3. What level of competence in solving mathematical problems do high school vocational agriculture students acquire?
4. What are the relationships between high school students' level of competence in solving mathematical problems and the following variables: a) teacher competence in solving mathematical problems; b) number of high school mathematics courses completed by students; c) sex of the students; d) class rank of the students; e) grade level of the students; f) whether a calculator was used in solving the problems; g) and how students rated themselves as mathematical problem solvers.

RELATED LITERATURE

Competence in the use of mathematics is needed for today's practical and technological world. Students possessing mathematical competence will be better equipped for the future. Mayer (1982) wrote,

> "Mathematics is the foundation for many fields including science, engineering, business, and economics, and is vital to individuals' everyday survival as consumers."

Taylor (1977) said:

> "The one overriding goal for mathematics instruction today is problem solving. We don't know exactly what problems students will face in the future, but we do know that they will be living in a world of change. Therefore, we must prepare them to deal with the wide range of problems that they will face in a variety of situations."

The Agenda for Action Document (1980) stressed that, "problem solving must be the focus of school mathematics in the 1980's."

Miller (1983) completed a study of principles, teachers, parents, and students where he examined their views on the role of vocational agriculture in developing and enhancing mathematical skills. One of Miller's conclusions was:

> ". . . math concepts were consistently regarded to be of greater-than-average importance. This observation indicates that mathematics should be an important part of education in vocational agriculture."

However, even though education consumers and providers agree that mathematics and mathematical problem solving are important, studies have shown that students lack competence in solving mathematical problems. Falakdine (1984) found that junior and senior vocational agriculture students studying production agriculture were at best only moderately competent in mathematical problem solving based upon a mathematical problem solving test in agricultural mechanics. Gliem and Warmbrod (1985) reported vocational agriculture students achieved at a relatively low level of competence on a test which measured their skill in performing the mathematical operations of addition, subtraction, multiplication, and division. Loadman (1986) found that the average scores of college preparatory students were 16 points higher on a mathematical test than vocational students' scores.

This brief review of literature supports the need for mathematical problem solving and also documents the poor competence of students in mathematical problem solving. The literature was lacking in regard to research related to teacher competence in problem solving and the relationship between teacher competence and its effect on student competence in mathematical problem solving.

METHODS

Three instruments, a Teacher Questionnaire, a Student Questionnaire, and a Mathematical Problem Solving Test were used to collect data. The same mathematical Problem Solving Test was used with both teachers and students. The 20-item test included one-step and multiple-step problems involving whole numbers, decimals or factions, and a combination of whole numbers and decimals or fractions. The Mathematical Problem Solving test had been developed previously by a panel of experts in agricultural mechanics instruction for use by high school vocational agriculture students. This panel was composed of selected teachers of vocational agriculture and professors of agricultural mechanization. The test had been tested for content validity and reliability (Cronbach's alpha = 0.84). Twenty items were selected in an attempt to yield a valid and reliable test that could be completed by students in one class period. The Teacher and Student Questionnaires were developed to collect information regarding the other variables being studied.

A census of 71 vocational agriculture teachers who had started teaching in 1980 and were still teaching in 1986 were surveyed during the Spring of 1986. They were asked to complete the Teacher Questionnaire and to take the Mathematical Problem Solving Test. They were also asked to have their most advanced class of vocational agriculture students complete the Student Questionnaire and Mathematical Problem Solving Test. Data were available for 54 vocational agriculture teachers and 656 freshmen, sophomore, junior, and senior vocational agriculture students.

Follow up mailings and telephone calls to nonrespondents were made to encourage completion and return of the instruments. An analysis of early and late respondents showed no differences between groups.

RESULTS

Vocational agriculture teachers had an average score of 12.35 (61.8 percent of the items correct) on the 20-item Mathematical Problem-Solving Test (Table 1). The distribution of scores ranged from 1 to 20 with a median score of 13.

Approximately twenty-eight percent of the teachers correctly solved 50 percent or less of the problems. Seventy-two percent of the teachers correctly solved over 50 percent of the problems. Four percent of the teachers correctly solved all problems on the Mathematical Problem-Solving Test.

Table 1
Scores on Mathematical Problem-Solving Test by
Teachers of Vocational Agriculture

Score	Frequency	Percent	Cumulative Percent
0	0	0.0	0.0
1	1	1.9	1.9
2	0	0.0	1.9
3	1	1.9	3.7
4	1	1.9	5.6
5	1	1.9	7.4
6	1	1.9	9.3
7	1	1.9	11.1
8	5	9.3	20.4
9	3	5.6	25.9
10	1	1.9	27.8
11	7	13.0	40.7
12	4	7.4	48.1
13	6	11.1	59.3
14	5	9.3	68.5
15	5	9.3	77.8
16	1	1.9	79.6
17	3	5.6	85.2
18	5	9.3	94.4
19	1	1.9	96.3
20	2	3.7	100.0
Total	54	100.0	

Mean = 12.35 S.D. = 4.36 Median = 13.00 Mode = 11.00

Table 2 shows the relationship between teacher score and selected teacher variables.

Table 2
Relationship Between Teacher Score and
Selected Teacher Variables

Variables	r	r_s	r_{pb}	n	p
Grade Point Average	.29			51	.019
Courses Utilizing the "Unit Factor Method"			.30	51	.017
Utilized a Written, Organized Procedure		.44		54	.001

A moderate positive association was found between teachers' scores and whether teachers utilized a written, organized procedure in solving problems ($r_t = .44$), whether teachers took a college course utilizing the "unit factor method" of teaching ($r_{pb} = .30$), and between teachers' scores and teachers' grade point average ($r = .29$). All other variables had no association with teachers' scores.

Stepwise regression analysis (Tables 3 and 4) identified only one variable, whether teachers utilized a written, organized procedure in solving problems, as a predictor of teacher score. Teacher utilization of a written, organized procedure increased the teacher's score on the problem-solving test. Regression analysis indicated that this variable contributed significantly to the equation when the other variables in the equation were held constant (Table 4). An examination of the residuals indicated that the assumptions basic to regression analysis were not violated.

Table 3
Summary Data for Regression of Teacher Score on Mathematical Problem-Solving Test on Teachers' Utilization of a Written, Organized Procedure to Solve Problems
$n=49$

Variable	Intercorrelations X_1	Y	Mean	S.D.
Written, Organized Procedure (X_1)	1.00	.46	4.29	5.89
Teacher Score (Y)		1.00	12.25	4.49

Table 4
Regression of Teacher Score on Mathematical Problem-Solving Test on Teachers' Utilization of a Written, Organized Procedure to Solve Problems
$n=49$

Variable	Partial Regression Coefficient	t	p
Written, Organized Procedure	0.35	3.57	.001
(Constant)	10.74		

$R^2=0.21$; $p<.001$; Standard Error=4.02

Vocational agriculture students had an average score of 5.64 (28.2 percent of the items correct) on the 20-item Mathematical Problem-Solving Test (Table 5). The distribution of scores varied from 0 to 20. The positively skewed distribution of scores had a median of 5.00.

Eighty-two percent of the students correctly solved 50 percent or less of the problems with fifty-six percent of the students correctly solving only 25 percent or less of the problems on the test. Eighteen percent of the students correctly solved over 50 percent of the problems. Four students (0.7 percent) correctly solved 90 percent or more of the problems. One student (0.2 percent) correctly solved all problems on the Mathematical Problem-Solving Test.

Table 5
Scores on Mathematical Problem Solving Test By Vocational Agriculture Students

Score	Frequency	Percent	Cumulative Percent
0	69	10.5	10.5
1	76	11.6	22.1
2	68	10.4	32.5
3	57	8.7	41.2
4	51	7.8	48.9
5	47	7.2	56.1
6	42	6.4	62.5
7	41	6.3	68.8
8	24	3.7	72.4
9	36	5.5	77.9
10	29	4.4	82.3
11	26	4.0	86.3
12	22	3.4	89.6
13	24	3.7	93.3
14	14	2.1	95.4
15	18	2.7	98.2
16	6	0.9	99.1
17	2	0.3	99.4
18	2	0.3	99.7
19	1	0.2	99.8
20	1	0.2	100.0
Total	656	100.0	
Mean - 5.64	S.D. - 4.54	Median - 5.00	Mode - 1.00

Table 6 shows the relationship between student score and selected student variables.

Table 6
Relationship Between Student Score and Selected Teacher Variables

Variables	r	r_s	r_{pb}	n	p
Class Rank		.32		650	.001
Grade Level			.18	655	.001
Number of Advanced Math Courses			.58	656	.001
Problem Solving Ability		.32		640	.001
Teacher Score	.15			605	.001
Use of Calculator			.34	651	.001

A substantial positive association was found between students' scores and the number of advanced mathematics courses completed (r_{pb} = .58). A moderate positive association was found between students' scores and whether they used a calculator (r_{pb} = .34), class rank (r_s = .32) and how they rated themselves as problem solvers (r_s = .32). A low positive relationship was found between students' scores and teachers' scores (r = .15) and grade level (r_{pb} = .18). Other variables had no association with students' scores.

Data reported in Table 7, indicate that higher scores on the Mathematical Problem-Solving Test were achieved by vocational agriculture students who had completed more high school courses in mathematics (algebra, plane geometry, solid geometry, trigonometry, and calculus), used a calculator when completing the test and rated their ability as problem-solvers higher.

Table 7
Student Scores on Mathematical Problem-Solving Test for Groups of Vocational Agriculture Students

Variable and Groups	n	$\bar{X}$	SD
Number of Advanced Math Courses			
0	211	3.04	2.93
1	139	4.41	3.85
2	128	6.53	4.33
3	100	8.25	4.59
4	50	9.52	3.96
5	25	11.00	4.44
Use of Calculator			
Yes	240	6.83	4.75
No	411	3.62	3.33
Problem Solving Ability			
Poor	55	2.89	3.32
Fair	259	4.58	4.03
Good	283	6.86	4.58
Excellent	43	8.16	5.29

The relationships between the aforementioned variables and student score on the Mathematical Problem-Solving Test were confirmed through regression analysis reported in Tables 8 and 9. Forty-one percent of the variance in students' scores on the test is explained by the linear combination of four variables - - number of advanced mathematics courses completed, whether a calculator was used when taking the test, how students rated themselves as problem-solvers, and teacher score on the Mathematical Problem-Solving Test. The regression analysis indicates that each of these variables contributes significantly to the equation when the other variables in the equation are held constant (Table 7). An examination of the residuals indicated that the assumptions basic to regression analysis were not violated.

Table 8
Summary Data for Regression of Student Score on Mathematical Problem-Solving Test on Selected Variables
n - 579

Variable	Intercorrelations					Mean	SD
	X_1	X_2	X_3	X_4	Y		
Number Advanced Math Courses (X_1)	1.00	.20	.35	.09	.57	1.29	1.40
Use of Calculator[a] (X_2)		1.00	.11	.04	.36	.63	.48
Problem Solving Ability[b] (X_3)			1.00	.02	.34	2.48	.74
Teacher Test Score (X_4)				1.00	.14	12.29	4.28
Student Test Score (Y)					1.00	5.65	4.47

[a] 1 - Did not use calculator; 2 - Used calculator

[b] 1 - Poor; 2 - Fair; 3 - Good; 4 - Excellent

Table 9
Regression of Student Score on Mathematical Problem-Solving Test on Selected Variables
n - 579

Variable	Partial Regression Coefficient	t	p
Number Advanced Math Courses	1.49	13.37	.001
Use of Calculator	2.25	7.44	.001
Problem Solving Ability	.87	4.21	.001
Teacher Test Score	.08	2.49	.01
(Constant)	.88		

R^2 - .41 p<.001 Standard error - 3.44

Students who had completed more high school courses in advanced mathematics (algebra and above) achieved higher scores on the test. Each additional mathematics course completed by students is associated with an increase of approximately 1.5 points on the 20-item test - - an increase of 7.5 percent.

Other studies (Gliem and Warmbrod, 1985, and Barrow, Mullis, and Phillis, 1982) have shown that students using calculators to solve mathematical problems score higher than students who do not use calculators. That finding was confirmed in the research reported in this paper in that students using calculators scored an average of 2.25 points higher (approximately an 11 percent increase) on the test than students who did not use calculators when completing the test.

Students ratings of themselves as mathematical problem-solvers, and teacher score on the Mathematical Problem-Solving Test were also significantly related to the scores students achieved on the test. When the other variables in the equation are held constant, one unit increase in each of these two variables accounted for approximately a 1 point (5 percent) increase in student score on the Mathematical Problem-Solving Test.

IMPLICATIONS

From the results of this study, the following implications are given:

1. Vocational agriculture teachers need instruction in mathematical problem solving as they are not competent in mathematical problem solving in agricultural mechanics. Their mean score of 12.4 or 62% on a twenty-item test is below the level of competence that should be expected.
2. Students of vocational agriculture need to be taught mathematical problem solving in agricultural mechanics. Their mean score of 5.6 or 28% on a twenty-item test of the type taken is below the level of competence needed for successful entry into today's work force.
3. Vocational agriculture teachers utilizing a written, organized procedure for solving mathematical problems scored higher on the test. It is therefore highly recommended that a written, organized procedure be utilized when solving mathematical problems in agricultural mechanics.
4. High school vocational agriculture students should be required to take advanced level mathematics courses.
5. Students in vocational agriculture should be encouraged to use calculators when solving mathematical problems.
6. Teacher educators and state supervisors need to jointly plan and provide inservice education for vocational agriculture teachers in mathematical problem solving in agricultural mechanics.
7. Curriculum materials need to be developed which will help teachers of vocational agriculture to easily, effectively, and efficiently teach mathematical problem solving in agricultural mechanics.

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CRITIQUE OF RESEARCH

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An Assessment of the Level of Cognitive Performance and Critical Thinking Ability of Selected Vocational Agriculture Students
(by Jamie Cano and Cathy Martinez)

Contribution to Knowledge

This study focuses on a topic that is receiving much attention in education today, and rightfully so. The thinking ability of students has been described as one of the most important educational concern at the secondary level. This study addresses some important research questions and provides data that describe secondary agriculture students' thinking skills. Since standardized tests were used to measure students' thinking skills, a greater contribution to knowledge could have been made by presenting norm data. The authors concluded that agriculture students tended to score higher on these tests than students from other disciplines, but I saw no data to support this claim. I also question the researchers' second conclusion that agriculture students are able to think critically through problem situations, since the overall percentage of correct responses on the critical thinking test was only 53%. The researchers learned that secondary students at all grade levels have basically the same level of thinking ability, which raises all kinds of interesting questions.

Theoretical Framework

The conceptual basis for this study was presented through a review of opinion about the importance of thinking skills for today's students. This position was then followed by a problem statement describing the lack of knowledge about secondary agriculture students' thinking skills. I challenge the researchers to be more clear in presenting a theoretical model that indicates why such knowledge is needed and how agricultural educators should act on such knowledge. The model should address such things as (1) the relationship between problem solving, levels of cognition, and critical thinking, (2) how thinking skills are acquired, taught, and learned, and (3) the extent to which thinking skills can be transferred to subsequent settings.

Procedures

The methods of conducting the study, including data analysis procedures, were appropriate. This portion of the study could be strengthened by providing better explanations in some areas. Why was a purposeful sample drawn? On what basis? How were potential design errors controlled? What are the validity and reliability estimates of the standardized tests? What was the nature of the tests?

Final Thoughts

This study represents one of the first steps in investigating a huge, extremely important area of research in agricultural education. These results cannot be generalized beyond the sample, but the study nevertheless provides an excellent starting point for a long-term research program.

The Relationship Between Critical Thinking Ability and Level of Cognitive Performance of Selected Vocational Agriculture Students
(by Jamie Cano and Cathy Martinez)

Contribution to Knowledge

(See discussant comments on other paper authored by Cano and Martinez based on the same study)

This study also presents evidence of a positive relationship between two standardized tests designed to measure students' thinking abilities. The significance of this finding for agricultural educators is unclear. What do we conclude from the finding of significant relationship between the two tests?

Procedures

(See discussant comments on other paper by same authors.)

The canonical correlation analysis procedures used in data analysis were appropriate for this study. Results were well presented in tabular form, but a few additional statements in the narrative would have been helpful in interpreting the results presented.

Final Thoughts

While the topic under investigation is of unquestionable importance, where we step from here in advancing our knowledge base is unclear. Several excellent ideas for further research are presented, most of which do not grow out of this study. While the major recommendation for practice contained in the paper is certainly acceptable to most in the profession, it does not have a clear basis in this study.

Mathematical Problem Solving Competence and Related Factors of High School Vocational Agriculture Teachers and Students
(by Kevin Persinger and Joe Gliem)

Contribution to Knowledge

This study examines a very important problem in education today -- the low ability of students in performing basic skills, specifically mathematical problem solving. From this study we have gained further knowledge of the mathematical problem solving ability of secondary agriculture students and teachers. We also have beginning explanations of the factors that influence teachers and students' math problem solving competence. The conclusions and recommendations listed in the paper are substantive, important, and clearly presented and supported. The authors should go one step further and suggest where we go from here in our quest to further explain the variance in teacher and student competence in solving math problems.

Theoretical Framework

The literature review contained several pieces emphasizing the importance of math problem solving ability and the appropriateness of ag mechanics as one setting for improving these skills. A lack of research on teacher competence and on the relationship between teacher competence and student math problem solving competence was cited.

This study needs an explicitly presented conceptual model that suggests what and how certain factors work to shape student and teacher competence. Some of these probable factors were examined in the correlational analysis, but there were gaps in the variables examined.

Procedures

In general, sound research procedures were used in designing the study and collecting and analyzing the data. Instrumentation procedures were appropriate. A sample problem from the test would have clarified the nature of the test. The rationale for selecting this sample was not stated. More information on nonrespondents was needed. The data analysis procedures were appropriate and clearly presented. The inclusion of regression analysis strengthened the overall contribution of the study.

Final Thoughts

This was a well-designed study that was straightforward in its approach to addressing the problem under investigation. This study makes a significant contribution to what we know about agricultural teacher and student math problem solving competence. The researchers should develop and continually refine a conceptual model that guides their long term research efforts in this area.

THE RELATIONSHIP BETWEEN THE PROFESSIONAL EDUCATION COMPONENT OF THE AGRICULTURAL EDUCATION CURRICULUM AND GRADUATE CAREER CHOICE

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INTRODUCTION

Although the number of secondary agricultural education teaching positions has declined over the past several years (Camp, 1987), agricultural educators have long been concerned with why graduates choose not to enter the teaching profession. Previous researchers addressing this issue have focused primarily upon demographic factors (Bell, 1950; Cheek, McGhee, & West, 1983) and factors associated with personal freedom and financial considerations (Chizek & Miller, 1984; Hoerner, 1965; Miller, 1974).

To date, there has been little research conducted in the profession regarding the possible influence of the following upon graduate career choice:

(1) grades received in the professional education component of the agricultural education curriculum;
(2) certification history; or
(3) academic ability.

The agricultural education preservice teacher curriculum consists of three components: (1) general education, (2) professional education, and (3) technical agricultural education (American Vocational Association, 1962).

In 1965, Hoerner found that perceptions of the quality of training in agricultural education influenced students' decision regarding initial job placement. Cole (1984) concluded that improvements were needed in both the student teaching program and other related coursework in an effort to influence more students to enter the teaching profession after graduation.

A number of researchers have asserted that agricultural education faculty members strongly influence graduates in terms of career choice. Dickens (1978) established that agricultural education faculty members greatly influenced graduates who selected teaching as a profession.

In a 1975-87 follow-up study, McGhee and Cheek (1989) found that almost 60 percent of agricultural education graduates in Florida were teaching. These same researchers reported that graduates rated the adequacy of their overall coursework between good and excellent. Agricultural education courses received the highest ratings in that same study.

PROCEDURES

Population and Sample

The population for this study was all agricultural education graduates enrolled in the preservice program who completed Student Teaching at The Ohio State University between Winter Quarter, 1980 and Winter Quarter, 1986 (N = 283). The composition of the sample included 160 purposefully selected graduates chosen upon their degree of coursework taken at The Ohio State University and availability of summative ratings by their cooperating teachers. A number of transfer students who had taken several education courses in the professional education component of the curriculum at other universities were excluded from the study.

Design of the Study

This was a descriptive-correlational study.

Instrumentation and Data Collection

Data were obtained from transcripts and state certification records located in both departmental and college offices.

Data Analysis

Descriptive statistics were used to summarize and analyze the data. Discriminant analysis was used to determine differences between whether or not students entered the teaching profession after graduation and a set of discriminating variables.

RESULTS

Description of Selected Variables

Cumulative Grade Point Average

Of the 160 graduates in the sample, cumulative grade point averages ranged from A- (2.4 %) to C (15 %). As indicated in Table 1, the cumulative grade point average was slightly greater than B- (X = 2.79, SD = .42).

Grades Received in Departmental Education Coursework

Of the 196 quarter hours required for graduation, 43 were required in the professional education component. Students also had the option of including courses associated with the undergirding disciplines of education (Psychology and Sociology) in the Social Sciences area of the general education component of the curriculum. Of the 43 hours in professional education, 28 were required in the department and 15 were required outside of the department.

Several researchers have inferred that cooperating teachers might also influence career choice. Moss and Briers (1982) indicated that student morale accounted for 8.5 percent of the variance in graduates' decision to enter the teaching profession. Byler and Byler (1984) disclosed that cooperating teacher acceptance of student teachers as professionals and school discipline significantly influenced the morale of student teachers. These same researchers concluded that cooperating teacher selection and training needed to be given a greater amount of consideration.

According to Cruickshank (1987), one of the ten forces affecting curriculum in teacher education is state governmental education agencies. Such agencies contain offices of teacher education and certification. Students interested in teaching as a profession are required to successfully complete a prescribed set of courses and provide documentation of successful completion.

Hoerner (1965) reported that one reason why agricultural education graduates did not enter the teaching profession was that they never had the aspiration to teach. Many such students may decide not to complete the state certification process. Similarly, Cole (1984) disclosed that 25 percent of Oregon agricultural education graduates who did receive state certification elected not to enter the teaching profession.

McCoy and Mortensen (1983) pointed out that graduates who enter the agricultural education teaching profession are more academically able. Relatedly, Raven and Warmbrod (1989) reported that agricultural education majors are as academically capable as other majors in terms of both entering and exiting college. Such findings within the profession are not consistent with research conducted outside of the profession. Schlechty and Vance (1981) observed that graduates who enter the teaching profession are those with lower cumulative grade point averages.

PURPOSE AND OBJECTIVES

The purpose of this study was to determine if student academic history in the professional education component of the agricultural education curriculum, cumulative grade point average, and certification history influenced graduates' career choice.

The specific objectives were:

1. To describe graduates in terms of cumulative grade point average, grades received in the professional education component of the curriculum, certification status, and career status.

2. To determine the extent to which the following might distinguish between graduates who entered the teaching profession and graduates who did not: (1) cumulative grade point average, (2) certification status, (3) grades received in Student Teaching, (4) grades received in selected departmental education courses, and (5) grades received in selected nondepartmental education courses.

Table 1

Overall Grade Point Average (n = 160)

Grade	Value	Frequency	Percent
A	4.00	0	0
A-	3.70	4	2.4
B+	3.30	18	11.2
B	3.00	26	15.9
B-	2.70	38	24.2
C+	2.30	50	31.3
C	2.00	24	15.0
Total		160	100

X = 2.79; SD = .42

As indicated in Table 2, graduates received an average letter grade between B+ and A- in coursework taken within the department. Specific numerical averages (based upon a four-point scale) were as follows: (1) Vocational and Extension Education in Agriculture (Introduction to Ag.Ed.): 3.60 (SD = .39); (2) Instructional Program Planning for Vocational Agriculture (Program Planning): 3.68 (SD = .33); (3) Student Teaching in Agriculture (Student Teaching): 3.42 (SD = .37); and (4) Methods in Teaching Vocational Agriculture and Extension Education (Methods): 3.34 (SD = .44). Letter grades ranged from C+ to A in Introduction to Ag. Ed. and Program Planning and from C to A in Methods and Student Teaching.

Grades Received in Nondepartmental Professional Education Coursework

Graduates received lower grades in professional education coursework taken outside of the department. Table 3 indicates that highest numerical averages were received in Professional Introduction II: 3.24 (SD = .66) and Philosophy or History of Education (History/Philosophy): 3.08 (SD = .63). Letter grade averages for the above-mentioned courses were between B and B+. Grades received in Professional Introduction I were lowest with an average letter grade falling between B- and B (X = 2.94, SD = .78).

Certification Status

Of the 160 graduates in this study, 90 percent completed the necessary coursework and documentation for certification (Table 4).

Table 2

Grades Received in Departmental Courses (n = 160)*

		Intro. to Ag. Ed.		Methods of Teaching Ag.		Program Planning		Student Teaching	
Grade	Value	f	%	f	%	f	%	f	%
A	4.00	49	30.6	21	13.1	46	28.8	9	5.6
A-	3.70	52	32.5	42	26.3	86	53.7	19	11.9
B+	3.30	38	23.8	41	25.6	13	8.1	88	55.0
B	3.00	14	8.7	38	23.8	9	5.7	32	20.0
B-	2.70	4	2.5	12	7.5	5	3.1	7	4.4
C+	2.30	3	1.9	5	3.1	1	.6	3	1.9
C	2.00	-	-	1	.6	-	-	2	1.2
Total		160	100	160	100	160	100	160	100
		X = 3.60 SD = .39		X = 3.34 SD = .44		X = 3.68 SD = .33		X = 3.42 SD = .37	

* Introduction to Ag. Ed. - three-quarter-hour course designed to orient students as to the purpose and importance of agricultural education (The Ohio State University, 1989).
Methods - five-quarter-hour course (including a laboratory) in which students learn how to prepare for instruction and utilize appropriate teaching methods.
Program Planning - three-quarter-hour course where students learn procedures and principles utilized in implementing vocational agriculture programs.
Student Teaching - 15-quarter-hour course where students engage in teaching and management of vocational agriculture programs.

Teaching Status

Over one-half of the 160 graduates in the study (n = 83) entered the teaching profession (Table 4).

Differences Between Teachers and Nonteachers on Selected Variables

For analysis purposes, grades from the following sources were averaged together: (1) departmental professional education courses (Methods, Program Planning, and Introduction to Agricultural Education); (2) nondepartmental professional education courses (Professional Introduction I, II, and History/Philosophy of Education); and (3) Student Teaching (assigned three separate grades for five credit-hours per grade).

Table 3

Grades Received in Professional Introduction I,
Professional Introduction II, and
History or Philosophy of Education (n = 160)*

		Prof. Intro. to Ed. I		Prof. Intro. to Ed. II		Hist. or Phil. of Ed.	
Grade	Value	f	%	f	%	f	%
A	4.00	23	14.4	34	21.3	20	12.5
A-	3.70	25	15.6	29	18.1	19	11.8
B+	3.30	18	11.3	24	15.0	28	17.5
B	3.00	20	12.5	40	25.0	46	28.8
B-	2.70	29	18.1	7	4.4	21	13.1
C+	2.30	15	9.4	7	4.4	14	8.8
C	2.00	16	10.0	13	8.1	8	5.0
C-	1.70	6	3.7	4	2.5	2	1.3
D+	1.30	5	3.1	1	.6	1	.6
D	1.00	3	1.9	1	.6	1	.6
Totals		160	100	160	100	160	100
		X = 2.94 SD = .78		X = 3.24 SD = .66		X = 3.08 SD = .63	

* Professional Introduction I & II - two separate six-quarter-hour courses designed to provide students with an understanding of human growth and development, instructional methods, cultural pluralism, and human relations (The Ohio State University, 1989).
Philosophy of Education - a three-quarter-hour course which centers upon the study of applying philosophy to problems and issues related to professional education in this country.
History of Modern Education - a three-quarter-hour course which traces the development of education and its relationship to other behavioral institutions.

Univariate analyses indicated that graduates who entered the teaching profession differed significantly on certification status ($p < .001$) and received significantly higher grades in Student Teaching ($p < .01$) when contrasted with graduates who did not enter the teaching profession (Table 5). Graduates who entered the teaching profession had a slightly higher cumulative grade point average. Both groups received similar grades in departmental and nondepartmental professional education coursework other than Student Teaching.

Discriminant analysis was utilized to determine if graduates who entered the teaching profession and graduates who did not enter the teaching profession could be determined based upon the five discriminating

Table 4

Certification and Teaching Status (n = 160)

Certification Status	Number	Percent	Teaching Status	Number	Percent
Certified	144	90	Teaching	83	51.9
Noncertified	16	10	Nonteaching	77	48.1
Total	160	100		160	100

Table 5

Means and Standard Deviations for Discriminating Variables

	Group				
Discriminating	Nonteachers (n = 77)		Teachers (n = 83)		Univariate
Variables	X	SD	X	SD	F-Ratio
Grade Point Average	2.77	.41	2.80	.44	.13
Student Teaching	3.33	.34	3.50	.38	8.44**
Departmental Professional Ed. Courses	3.54	.26	3.54	.33	.01
Nondepartmental Professional Ed. Courses	3.09	.43	3.09	.49	.01
Certification Status*	.79	.41	1.00	.01	21.50***

* 0 = not certified, 1 = certified; ** $p < .01$; *** $p < .001$

variables in the study. The discriminant function was statistically significant ($p < .001$) indicating that graduates who entered the teaching profession could be distinguished from graduates who did not enter the teaching profession by the set of variables included in the analysis (Table 6). The proportion of variance in the discriminant function that was explained by the two groups (teachers and nonteachers) was approximately 16 percent ($R_c = .399$).

According to Klecka (1980), within-group structure coefficients are beneficial in explaining the nature of the discriminating functions. Higher cumulative grade point averages, certification to teach, and high grades in Student Teaching and in other departmental professional education courses were associated with graduates who entered the teaching

Table 6

Summary Table for Discriminant Analysis ($n = 160$)
Discriminant Function 1

Variables	b	s	Group	Centroids
Grade Point Ave.	-.02	.07	Nonteachers	-.448
Student Teaching	.56	.53	Teachers	.416
Departmental Professional Ed. Coursework	-.06	.01		
Nondepartmental Professional Ed. Coursework	-.09	-.01		
Certification Status	.83	.85		

Eigenvalue = .189; *Rc* = .399; *Wilks' Lambda* = .841; $p < .001$

b = standardized discriminant function coefficient
s = within-groups structure coefficient
Rc = canonical correlation coefficient

profession. Graduates who did not enter the teaching profession tended to receive slightly higher grades in nondepartmental educational coursework.

The standardized discriminant function coefficients indicate the relative importance of the discriminating variables (Warmbrod, 1988). The most highly distinguishing attributes of graduates who entered the teaching profession were Student Teaching grade and certification status. Grades in departmental professional education coursework (other than Student Teaching), nondepartmental professional education coursework, and higher cumulative grade point averages were of lesser importance in describing graduates who entered the teaching profession.

The discriminant function resulted in 63 percent of the cases being correctly classified. The classification based on the discriminating variables resulted in 26 percent fewer (tau = .263) errors than would be expected by random assignment (Table 7).

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Agricultural education graduates maintained a cumulative grade point average of 2.79. This finding is comparable with follow-up research conducted in Florida (Cheek, McGhee, & West, 1983).

Table 7

Classification Results

Classification of Cases

Actual Group	No. of Cases	Predicted Group Nonteachers	Predicted Group Teachers
Nonteachers	77	33 (42.9%)	44 (57.1%)
Teachers	83	15 (18.1%)	68 (81.9%)

Percent of cases correctly classified: 63.13%

In terms of the professional education component of the agricultural education curriculum, grades were higher in departmental coursework than in nondepartmental coursework.

Ninety percent of the graduates completed the necessary coursework and documentation for state teacher certification. Over one-half of the graduates entered the teaching profession. The number of Ohio agricultural education graduates electing not to enter the teaching profession is somewhat higher than was reported in similar studies conducted in Oregon (Cole, 1984) and Iowa (Chizek & Miller, 1984; Hoerner, 1965).

Graduates who entered the teaching profession could be distinguished from graduates who did not by a set of variables relating to cumulative grade point average, grades in Student Teaching, grades in the professional education component of the curriculum (both departmental and nondepartmental), and certification status. The most powerful discriminating variables were certification status and grade in Student Teaching.

Lower grades in Student Teaching might reflect graduates' dissatisfaction with the overall preservice experience. Both Cole (1984) and McCoy and Mortensen (1983) found that graduates who did not teach exhibited less satisfaction with their student teaching experiences. Relatedly, Campbell and Williamson (1973) established that the most important factor in determining the success of Student Teaching centered upon the preservice teacher's relationship with the cooperating teacher.

Recommendations

Teacher educators in agriculture should continue their efforts to encourage scholarship on the part of preservice students in all coursework, especially in the professional education component of the curriculum. The National Research Council (1988) called upon agricultural educators to increase linkages with colleagues in other educational disciplines.

Encouragement concerning academic achievement should begin early in the student's program and should continue throughout. It is particularly important that teacher educators point out the necessity for future teachers of agriculture to be experts not only in technical agriculture but also in the application of teaching and learning principles.

Barrick (1988) warned that an "unexamined discipline may not last" (p. 8). Teacher educators should continue to evaluate and modify departmental course offerings in an effort to spark the enthusiasm of all preservice students. There is a need for continuous replication of research regarding departmental course offerings. Studies as conducted by Deeds (1985) on the early experience program, Pfister (1982) on the student teaching program, Peters (1980) on microteaching, and Powell (1986) on program planning should be periodically updated.

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COGNITIVE LEVELS OF INSTRUCTION AND STUDENT PERFORMANCE IN SELECTED COLLEGE OF AGRICULTURE COURSES

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The dynamics of American society have resulted in continued demands for reforms in our nation's educational system. Many educational reforms being sought presently are in response to a report prepared by the National Commission on Excellence in Education entitled A Nation at Risk. Included in this noted report are recommendations that steps be taken to develop problem solving, critical thinking and higher level thinking abilities of all students (pp 25 - 27).

THEORETICAL BACKGROUND

In order to consider the challenge issued by the National Commission on Excellence in Education, it is necessary to define what is meant by problem solving, critical thinking, and higher level thinking ability. Bloom, Englehart, Furst, Hill and Krathwohl (1956) labelled these forms of thinking as "intellectual abilities and skills" and operationally defined evidence of these abilities and skills as an individual being able to "find appropriate information and techniques in his previous experience to bring to bear on new problems and situations" (pg 28). Intellectual ability, by this definition, requires that thinking occur beyond the mere memorization and recall of facts.

The Taxonomy of Educational Objectives - Cognitive Domain developed by Bloom, et. al. (1956) distinguishes between recall of facts and demonstration of intellectual skills and abilities. This taxonomy represents a hierarchy of cognitive levels of educational objectives beginning with knowledge, or recall of facts, and progressing through the various intellectual skills and abilities in the cognitive domain. The higher levels of cognition include comprehension, application, analysis, synthesis and evaluation. Bloom considered the six levels noted to be cumulative and hierarchical in that performance at any higher cognitive level required the use of all preceding levels of cognition.

Bloom's definition of intellectual ability, which includes the five highest levels of cognition, does not distinguish between the specifics of problem solving, critical thinking and higher level thinking. It does, however, provide a point of reference for considering the type of thinking abilities which are to be developed in students. Utilizing this point of reference, the need for student development of these abilities may be considered.

Bloom's arguments for fostering the development of student's intellectual abilities were similar to those of the National Commission on Excellence in Education for developing students' critical thinking, problem solving, and higher-order thinking skills. Bloom observed that:

> "we find ourselves in a rapidly changing and unpredictable culture, ... we have the task of preparing individuals for problems which cannot be seen in advance, and about all that can be done under such conditions is to help the student acquire generalized intellectual skills and abilities which will serve him in many new situations." (p. 40)

Similar sentiments regarding the need for the development of critical thinking, problem solving and higher order thinking skills of students at the postsecondary level have been expressed by individuals concerned with higher education. McKeachie (in Joscelyn, 1988) stated that "everyone agrees that students learn in college, but whether they learn to think is more controversial" (pg. 1). Bransford and Vye (1989) also noted that "many traditional approaches to instruction do not help students make the transformation from 'knowing that' something is true to 'knowing how' to think, learn and solve problems" (pg. 193).

Teaching student how to think, or developing their critical thinking and problem solving skills has been identified as a goal of educators in colleges of agriculture as well. Harl (1980) stated that among the abilities which every university graduate in agriculture should possess is "The ability to think and reason - creatively, analytically, thoroughly and with reasonable alacrity" (pg. 5). Poulton (1985) argued that one criteria of quality agricultural education is the development of "critical thinking, to reason logically and apply problem solving techniques appropriately" (pg. 19).

Other university agricultural educators concur with these arguments and have pointed out the need for developing critical thinking and problem solving skills in agriculture students. Kuhn (1977) suggested that "the total mass of knowledge in agriculture to be learned is too great for an individual to learn it all well." Newcomb and Trefz (1987) agreed that knowledge is growing rapidly among the agricultural disciplines. This expanding knowledge base dictates that teachers in colleges of Agriculture must evaluate the manner in which students are prepared to serve as professional agriculturalists.

RELATED LITERATURE

Research considering the cognitive levels of instruction has focused on a number of areas which include instructor discourse, tests, quizzes and assignments. Fischer and Grant (1983), Gall (1970), and Pickford (1988) reported that the preponderance of instructor discourse observed in their research took place at the lowest levels of cognition (knowledge and comprehension). Cross and Angelo (1988), Milton (1982), Newcomb and Trefz (1987), and Pickford (1988) found that tests and quizzes reflected the emphasis placed upon the lower levels of cognition in instructor oral presentations. Chickering (1972) reported that assignments "varied in ways consistent with the mental activities used in class" (pg 137).

Findings of these and other studies indicate that instruction typically focuses upon the knowledge, comprehension and application levels of cognition; the three lowest levels identified by Bloom. These findings raise concerns in light of the fact that cognitive researchers theorize that students will lack proficiency at operating at all levels of cognition if instruction does not provide opportunities for students to attain and master cognitive abilities at all levels (Pickford, 1988). Further empirical research is required to determined whether this is indeed the case.

Additional research has been done which considers the cognitive aspects of teaching and learning involving problem solving, critical thinking and higher level thinking. However, studies in these areas focusing upon higher education, and in particular colleges of agriculture, is extremely limited. In order to broaden the knowledge base in this area, this study considered the extent to which instruction occurred, and student performance was evidenced, at the higher levels of cognition as identified by Bloom's Taxonomy of Educational Objectives.

PURPOSE AND OBJECTIVES

The purpose of this study was to describe the cognitive level of experiences in selected courses in the Ohio State University College of Agriculture and evaluate the cognitive performance of the students enrolled in these courses. The study also sought to identify course experiences which were associated with student performance at higher levels of cognition. Research questions guiding the study were as follows: (1) What were the cognitive levels of instructor discourse (in-class instruction), tests and quizzes, and assignments in the selected courses? (2) What was the ability of students to perform at various levels of cognition upon completing selected courses? (3) To what extent did relationships exist between the cognitive levels of course experiences (instructor discourse, tests and quizzes, assignments) and students' cognitive level of performance?

PROCEDURE

This study was descriptive in nature. The population consisted of 127 students enrolled in four introductory level courses in the Ohio State University College of Agriculture during Spring Quarter, 1989. Courses were purposefully selected to represent four disciplines in the college (animal science, plant science, food science and social science). Instructor willingness to participate in the study and knowledge of the instructor's interest in improving his/her teaching performance also served as selection criteria.

The cognitive level of instruction in each course considered was assessed using the Florida Taxonomy of Cognitive Behavior (FTCB) (Brown, Ober, Soar & Webb, 1968). Developed from Bloom's Taxonomy, the FTCB was used to classify instructor behaviors, statements or questions into one of seven levels of cognition represented on the instrument. Validity of the FTCB is based upon its direct derivation from Bloom's Taxonomy. Consequently, the FTCB was considered valid in light of the support generally given to Bloom's Taxonomy as a means for identifying behaviors at the various levels of cognition. Reliability of the FTCB was dependent upon the raters' utilization of the instrument. The single rater responsible for assessment of the cognitive levels of instruction and student performance in the study posted reliability coefficients of .98 and .99 in using the FTCB for two separate training observations. These observations concluded formal training in the use of the FTCB which took place prior to the start of classes involved in the study.

Three class sessions were observed at three week intervals in each of the courses to assess the cognitive levels of instructor discourse. Additionally, all tests, quizzes, assignments and final examinations in each of the courses were collected and the cognitive level of each item appearing on these documents was determined using the FTCB.

Student cognitive performance was evaluated using course final examinations. The percentage of items correct at each of the levels of cognition appearing on the final examinations were calculated for each student.

Individual student cognitive performance scores were required to consider relationships between the cognitive levels of student performance and course experiences. In order to obtain such scores, weighted cognition scores of individual items were calculated by multiplying the percentage of possible points given the item by the instructor by a value reflecting the cognitive level of the item. Cognitive level weighting values used were those employed by Pickford (1988) in a similar study. These values were: knowledge, .10; translation, .20; interpretation, .25; application, .30; analysis, .40; synthesis, .50 and evaluation, .50. Individual student cognitive performance scores were obtained by summing the weighted cognition scores of all correct items on the final examination.

Values representing the cognitive level of course experiences, including instructor discourse, tests and quizzes, and assignments, were calculated for each course studied. The percentage of discourse, test and quiz items, or assignment items appearing at each level of cognition were multiplied by their respective cognitive level weighting values and summed in order to obtain single values indicative of the relative level of cognition evidenced in each course experience. Pearson product moment correlations were calculated between these values and standardized student cognitive performance scores on the final exam.

FINDINGS

Instructor discourse occurred primarily at the knowledge and comprehension levels of cognition as Table 1 indicates. An average of 40% of the discourse observed was at the knowledge level while 33% was at the comprehension level. An average of 17% occurred at the analysis level of cognition. A small percentage (<11%) of instructor presentations were at the application level in each of the courses. Few or no instructor behaviors indicative of the synthesis and evaluation levels of cognition were observed. The percentage of instructor discourse occurring at each level of cognition in each of the courses was similar.

Table 1. Percent of Instructor Discourse at Each Level of Cognition

Level of Cognition	COURSE 1	2	3	4	Mean
Knowledge	34.5	38.8	45.3	42.5	40.5
Translation	23.3	17.7	7.6	12.0	15.1
Interpretation	18.2	22.8	15.6	17.2	18.4
Application	5.5	6.2	10.2	7.3	7.3
Analysis	14.9	13.8	20.9	19.3	17.2
Synthesis	0.0	0.0	0.4	1.7	0.5
Evaluation	3.6	0.7	0.0	0.0	1.1
	100.0	100.0	100.0	100.0	100.1

Three of the four courses studied gave tests and/or quizzes during the quarter. An average of 61% of the value given these tests/quizzes was reflected in items written at the knowledge level of cognition (Table 2). An additional average of 15% of the test/quiz values were at the comprehension level. Analysis was required for a mean of 12% of the tests/quizzes. Questions requiring students to synthesize or evaluate information comprised less than eight percent of the value of tests and quizzes analyzed in any of the courses.

Table 2. Percent of Total Test and Quiz Value at Each Level of Cognition

Level of Cognition	COURSE 1	2	3	4*	Mean
Knowledge	48.7	63.1	70.0	0.0	60.6
Translation	8.3	0.6	1.0	0.0	5.0
Interpretation	8.3	21.1	1.0	0.0	10.1
Application	10.9	7.2	0.0	0.0	6.0
Analysis	16.0	4.7	15.5	0.0	12.1
Synthesis	0.6	0.0	7.5	0.0	2.7
Evaluation	7.2	3.3	0.0	0.0	3.5
	100.0	100.0	100.0	0.0	100.0

* no tests or quizzes given in course

The distribution of items across the levels of cognition varied to a greater extent on assignments than on discourse or tests and quizzes. As Table 3 indicates, assignments in courses one and three emphasized tasks requiring knowledge and comprehension while in courses two and four assignments focused upon analysis, synthesis and evaluation level tasks. A greater percentage of items on assignments required students to think at the higher levels of cognition than did test and quiz items or discourse provided by the instructor.

Table 3. Percent of Course Assignments Value at Each Level of Cognition

	COURSE				
Level of Cognition	1	2	3	4	Mean
Knowledge	13.3	0.0	50.0	0.0	15.8
Translation	16.7	0.0	0.0	0.0	4.2
Interpretation	13.3	0.0	0.0	0.0	3.3
Application	39.2	16.7	31.3	0.0	21.8
Analysis	12.5	0.0	0.0	13.3	6.5
Synthesis	0.0	33.3	18.7	73.3	31.3
Evaluation	5.0	50.0	0.0	13.3	17.1
	100.0	100.0	100.0	99.9	100.0

Table 4 presents the percent of items at each level of cognition appearing on the course final examinations. As was the case with tests and quizzes, an average of nearly 60% of the value of the final exams was comprised by items at the knowledge level of cognition. Items at the translation, interpretation, application or synthesis levels accounted for no more than 14% of any of the finals. While 28% of the final examination in course #1 was devoted to evaluation items, the three remaining final examinations had no questions at this level. No final examination in the study included items at all seven levels of cognition.

Student performance as evidenced by correct responses to items at the various levels of cognition varied within and among courses (Table 5). The mean percentage of correct responses at each level ranged from 51% to 100%. No clear evidence of superior student performance at any single level or group of levels was indicated when considering performance among courses.

Pearson product moment correlations between standardized student cognitive performance scores and the cognitive levels of instruction indicated that a moderate positive relationship appeared to exist between student performance and the cognitive level of tests and questions (rho = .34). Low or negligible negative relationships were indicated between student performance and the two remaining course experiences considered (instructor discourse rho = -.29; assignments rho = -.07).

Table 4. Percent of Final Examination Value at Each Level of Cognition

	COURSE				
Level of Cognition	1 50 items	2 17 items	3 50 items	4 75 items	Mean
Knowledge	40.0	50.0	80.0	63.0	58.3
Translation	8.0	0.0	2.0	7.0	4.3
Interpretation	4.0	10.0	4.0	5.0	5.7
Application	6.0	14.0	4.0	5.0	7.3
Analysis	14.0	20.0	10.0	20.0	16.0
Synthesis	0.0	6.0	0.0	0.0	1.5
Evaluation	28.0	0.0	0.0	0.0	7.0
	100.0	100.0	100.0	100.0	100.1

Table 5. Means and Standard Deviations of Percentage of Correct Responses at Each Level of Cognition on Course Final Examinations

	Course			
Level of Cognition	1 (n=25)	2 (n=21)	3 (n=37)	4 (n=44)
Knowledge	68.7	74.9	79.4	73.0
	(15.5)	(19.2)	(12.3)	(11.4)
Translation	71.7	**	80.6	56.7
	(24.2)		(40.1)	(25.7)
Interpretation	56.5	63.5	86.1	84.5
	(31.3)	(21.2)	(30.7)	(22.1)
Application	66.7	81.2	67.5	69.0
	(20.5)	(15.0)	(32.5)	(25.2)
Analysis	50.9	95.9	81.1	64.5
	(13.2)	(6.2)	(20.8)	(13.7)
Synthesis	**	100.0	**	**
		(0.0)		
Evaluation	60.8	**	**	**
	(15.3)			

** no items included at level indicated

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Conclusions reached in considering the findings of the study were as follows: (1) Instructor discourse in the courses studied occurred primarily at the lower levels of cognition, namely the levels of knowledge and comprehension. (2) The cognitive level of performance expected by instructors on tests, quizzes and final examinations was comparable to the instructors' cognitive level of discourse. (3) Assignments given by instructors in this study were, as a whole, designed to assess student performance at higher levels of cognition than were tests and quizzes given. (4) The cognitive levels of instructor discourse, tests and quizzes, or assignments did not appear to be clearly associated with student cognitive performance.

Instructor discourse, tests, and quizzes assessed in this study indicated that instructors focused upon student thought at the lowest levels of cognition (knowledge and comprehension). While instruction at the lower levels of cognition is a necessary prerequisite for higher level thinking (Bloom, et. al., 1956), it appears that instructors should also demonstrate to students the thought processes associated with the application, analysis, synthesis and evaluation of information. Students should also have an opportunity to demonstrate these thought processes on tests and quizzes. Instructors who teach and test at higher levels of cognition allow their students more opportunities to perform at higher levels of cognition.

Assignments evaluated in this study were used to encourage students to apply, analyze, synthesize and evaluate information to a greater extent than instructor discourse or tests and quizzes. Placing greater emphasis upon assignments may serve as a means for encouraging student thinking at the higher levels of cognition.

Inasmuch as no aspect of instruction considered was clearly related to student cognitive performance, further research is needed to determine whether these, or other, factors impact upon the cognitive performance of students.

Considering facts and insights gathered in the course of this study, the following recommendations are offered. (1) Greater attention should be given by instructors to conduct discourse at the application, analysis, synthesis and evaluation levels of cognition in order to further expose students to thought at these levels. (2) Tests, quizzes and final examinations should contain items at all levels of cognition in order to allow students to practice and demonstrate thought at the higher levels of cognition. (3) Consideration should be given to allocating a greater percentage of students' final grades to assignments thereby placing greater emphasis upon an aspect of instruction which may often require students to think beyond the knowledge and comprehension levels of cognition. (4) Instructors should be provided with opportunities to learn about, and improve upon, their teaching and evaluation practices which may impact upon student cognitive performance. (5) Further research should be conducted which seeks to identify those factors which impact upon student cognitive performance.

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THE IMPACT OF INCREASED ADMISSION REQUIREMENTS ON STUDENTS' ACADEMIC CREDENTIALS UPON ENTRY TO A COLLEGE OF AGRICULTURE

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PROBLEM STATEMENT

The use of selective admission policies by colleges and universities raises a number of issues concerning agricultural education in the secondary schools. Of particular concern is the impact that the importance placed on a college preparatory curriculum in high school and the increased entrance requirements may have on enrollment in vocational agriculture in high school and on enrollment of vocational agriculture students in colleges of agriculture. The purpose of this research was to describe how a selective admissions policy influences the academic qualifications and credentials of students entering the College of Agriculture at The Ohio State University and to explore the extent to which enrollment in vocational agriculture in high school impedes or enhances students completing the required college preparatory curriculum.

OBJECTIVES

Using data for a seven-year period, 1982-83 to 1988-89, the following research questions were studied:

1. What percent of the freshman entering the College of Agriculture at The Ohio State University complete the college preparatory curriculum required for unconditional admission?

2. To what extent does enrollment in vocational agriculture in high school influence the percentage of entering freshman who complete the college preparatory curriculum required for unconditional admission?

RELATED LITERATURE

A commonality of the educational reform reports of the 1980s is the recommendation of a core curriculum for all high school students (Adler, 1982; Boyer, 1983; Goodlad, 1984). Missing from the proposed core curriculum is vocational education courses. In addition to reform in high schools, these reports advocate increased admission requirements for institutions of higher education (The National Commission on Excellence in Education, 1983). McCurdy (1982) contended it is the inability of students to do college level work that prompts many colleges and universities to tighten admission requirements. These increased admission requirements stress college preparatory courses and usually exclude vocational courses taken in high school.

The trustees at The Ohio State University announced in April, 1982, a policy requiring entering freshmen to complete a college preparatory curriculum in high school in order to be admitted unconditionally. The policy took effect autumn quarter, 1984. The college preparatory requirements include four units of English, three units of math, two units of social science, two units of science, two units of foreign language, one unit of visual/performing arts, and one additional unit in any of the required subjects except visual/performing arts. A student not meeting the requirements is admitted on a "conditional" basis, the condition being to take courses in deficient subjects that do not count toward graduation or to show competence in the deficient area by placement tests.

There is evidence of a negative relationship between the number of units of vocational agriculture completed in high school and the number of college preparatory courses completed (Warmbrod & Doerfert, 1987); however, there is also evidence that enrollment in vocational agriculture in high school does not necessarily prevent students from completing a college preparatory curriculum (Newman & Warmbrod, 1986). Research indicates students who study vocational agriculture in high school perform academically just as well in college as students who do not study vocational agriculture, and that a higher proportion of college students who are former vocational agriculture students graduate than do college students who have not studied vocational agriculture in high school (Carpenter & Rogers, 1970; Newcomb, 1978; Warmbrod & Doerfert, 1987; Warmbrod & Phipps, 1966).

Method

The study was descriptive research. The academic characteristics and high school course patterns of freshman entering the College of Agriculture at The Ohio State University were studied before and after the implementation of the conditional/unconditional admissions policy. Data were collected from the population of new first quarter freshmen entering in autumn quarters in 1982 (n=169), 1983 (n=143), 1984 (n=177), 1985 (n=161), 1986 (n=160), 1987 (n=161), and 1988 (n=191). The data were obtained from transcripts submitted by high schools as part of a student's application for admission to the university. Descriptive statistics were used in data analysis.

RESULTS

Unconditional Admission

The percentage of entering freshman who completed the college preparatory curriculum required for unconditional admission has increased consistently since 1982. In 1982, 12% of all freshman would have been admitted unconditionally; in 1988, four years after the implementation of the admission standards, 83% were admitted unconditionally (Table 1).

Table 1

Conditional/Unconditional Admission Status of New First Quarter Freshman

Admission Status	1982 (n=169) %	1983 (n=143) %	1984 (n=177) %	1985 (n=161) %	1986 (n=160) %	1987 (n=161) %	1988 (n=191) %
All Students							
Conditional	88	77	70	44	36	31	17
Unconditional	12	23	30	56	64	69	83
0 years of VoAg							
Conditional	83	64	62	23	17	20	12
Unconditional	17	36	38	77	83	80	88
1+ years of VoAg							
Conditional	94	88	78	57	53	40	22
Unconditional	6	12	22	43	47	60	78

The percentage of students completing the required number of units in English, mathematics, science, and foreign language has also increased steadily since 1982 (Table 2). There has been an especially marked increase in the percentage of students completing the foreign language requirement. In 1982, only 43% of entering freshman had completed two or more units of foreign language; in 1988, 92% had completed the required number of units. There has been a moderate increase in the percentage of students meeting the visual/performing arts requirement through completion of courses such as art, drama, band, and chorus. However, enrollment in vocational agriculture can be used to meet the requirement for visual/performing arts; therefore, all students completing at least one year of vocational agriculture meet this requirement. For example, one-half of the students who had completed one or more years of vocational agriculture entering in the fall of 1988 fulfill the visual/performing arts requirement through this provision. The percentage of students completing two or more units of social science has not changed noticeably since 1982, varying from 97% to 100%.

Table 2. Percent of Entering Freshman Completing Courses Required for Unconditional Admission

Course and No. of units	1982 (n=169) %	1983 (n=143) %	1984 (n=177) %	1985 (n=161) %	1986 (n=160) %	1987 (n=161) %	1988 (n=191) %
English							
All Students							
Less than 4	48	30	25	5	5	5	3
4 or more	52	70	75	95	95	95	97
0 years VoAg							
Less than 4	40	18	19	0	0	6	1
4 or more	60	82	81	100	100	94	99
1+ years VoAg							
Less than 4	56	40	31	8	10	4	5
4 or more	44	60	69	92	90	96	95
Math							
All Students							
Less than 3	28	17	8	11	10	6	6
3 or more	72	83	92	89	90	94	94
0 years VoAg							
Less than 3	20	8	3	10	3	4	3
3 or more	80	92	97	90	97	96	97
1+ years VoAg							
Less than 3	38	25	14	11	16	6	9
3 or more	62	75	86	89	84	94	91
Social Science							
All Students							
Less than 2	3	0	2	0	0	0	0
2 or more	97	100	98	100	100	100	100
0 years VoAg							
Less than 2	4	0	1	0	0	0	0
2 or more	96	100	99	100	100	100	100
1+ years VoAg							
Less than 2	2	0	3	0	0	0	0
More than 2	98	100	97	100	100	100	100
Science							
All Students							
Less than 2	18	13	11	6	2	1	0
2 or more	82	87	89	94	98	99	100
0 years VoAg							
Less than 2	13	9	3	0	0	1	0
2 or more	87	91	97	100	100	99	100
1+ years VoAg							
Less than 2	23	17	18	9	5	1	0
2 or more	77	83	82	91	95	99	100

(Table Continues)

Course and No. of units	1982 (n=169) %	1983 (n=143) %	1984 (n=177) %	1985 (n=161) %	1986 (n=160) %	1987 (n=161) %	1988 (n=191) %
Foreign Language							
All Students							
Less than 2	59	57	42	35	24	17	8
2 or more	41	43	58	65	76	83	92
0 years VoAg							
Less than 2	39	30	24	11	7	0	4
2 or more	61	70	76	89	93	100	96
1+ years VoAg							
Less than 2	80	80	61	50	41	30	13
2 or more	20	20	39	50	59	70	87
Visual/Performing Arts[a]							
All Students							
Less than 1	49	54	51	42	44	37	33
1 or more	51	46	49	58	56	63	67
0 years VoAg							
Less than 1	44	45	45	16	22	14	16
1 or more	56	55	55	84	78	86	84
1+ years VoAg							
Less than 1	54	61	58	58	65	54	50
1 or more	46	39	42	42	35	46	50
Visual/Performing Arts[b]							
All Students							
Less than 1	14	14	15	4	6	5	4
1 or more	86	86	85	96	94	95	96
0 years VoAg							
Less than 1	26	30	30	10	12	11	8
1 or more	74	70	70	90	88	89	100
1+ years VoAg							
Less than 1	0	0	0	0	0	0	0
1 or more	100	100	100	100	100	100	100

[a] Includes courses in art, drama, band, chorus, and speech only.

[b] Includes courses in vocational agriculture and industrial arts in addition to art, drama, band, chorus, and speech.

Since the implementation of the admissions policy in 1984 entering freshman have improved in rank in high school graduating class (Table 3) and in the total number of high school credits earned (Table 4). The percentage of entering freshman who were in the highest quartile of their graduating class was 52% in 1982 and 54% in 1983. From 1984 through 1987, the percentage of entering freshman who were in the highest quartile of their high school class was 62% except for 1986 when it was 57%. In 1988, the percentage of entering freshman who were in the highest quartile increased to 65%.

Table 3

High School Class Rank of Entering Freshman

Percentile	1982 (n=169) %	1983 (n=143) %	1984 (n=177) %	1985 (n=161) %	1986 (n=160) %	1987 (n=161) %	1988 (191) %
Upper Quartile							
All students	52	54	62	62	57	62	65
0 years Vo-Ag	49	51	63	61	55	70	68
1+ years Vo-Ag	60	57	60	64	60	57	61
Second Quartile							
All students	29	35	25	25	29	28	29
0 years Vo-Ag	29	38	25	18	30	20	23
1+ years Vo-Ag	29	32	26	29	29	33	34
Third Quartile							
All students	14	8	11	10	12	9	7
0 years Vo-Ag	18	11	10	16	13	7	9
1+ years Vo-Ag	9	7	13	6	10	10	5
Lowest Quartile							
All students	5	2	1	2	1	1	0
0 years Vo-Ag	8	0	2	5	2	3	0
1+ years Vo-Ag	2	4	0	1	1	0	0

The total number of high school credits earned by entering freshman has shown a consistent increase from a mean of 22 in 1982 to more than 23 in 1988. The mean ACT composite score of entering freshman has increased slightly since 1982 to an average of slightly over 22 (Table 4).

Influence of Enrollment in High School Vocational Agriculture

The percentage of new first quarter freshmen entering the College of Agriculture who studied vocational agriculture in high school has ranged from a low of 49% in 1982 to a high of 61% in 1985 (Table 5). Since 1984 over half of the entering freshman have studied vocational agriculture in high school. The vast majority of students who have studied vocational agriculture in high school completed three or four years of vocational agriculture.

Data reported in Table 2 indicate that trends described for the percentage of all entering freshmen who meet the required admission standards for English, mathematics, science, visual and performing arts, and social science hold for students who have studied vocational agriculture in high school as well as for students who have not studied vocational agriculture. There are differences, however, between the vocational agriculture and no vocational agriculture groups in the percentage of students who were admitted unconditionally and the percentage who met the admission standard for foreign language. Consistently since

Table 4

Characteristics of Entering Freshman at the Time of Admission

	1982		1983		1984		1985		1986		1987		1988	
Variable	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
High School Rank Percentile														
All students	71.6	23.48	75.0	19.97	76.2	20.15	76.8	20.81	74.6	20.22	76.5	18.49	79.1	16.15
0 years Vo-Ag	67.3	25.96	74.4	19.84	75.7	20.86	74.8	25.83	74.4	21.60	79.1	20.25	80.2	16.15
1+ years Vo-Ag	76.2	19.59	75.4	20.20	76.7	19.49	78.1	16.89	74.7	19.00	74.6	16.87	78.0	15.15
Total High School Credits														
All students	22.0	1.90	22.2	1.84	22.4	1.89	22.8	1.79	22.9	2.10	23.3	2.23	23.6	2.06
0 years Vo-Ag	21.9	2.07	22.0	2.09	22.3	1.89	22.7	2.06	22.9	2.22	22.7	2.32	23.3	2.08
1+ years Vo-Ag	22.1	1.71	22.3	1.60	22.6	1.90	22.9	1.60	22.8	1.98	23.8	2.05	23.9	2.01
ACT Composite Score														
All students	20.8	5.21	21.7	5.48	21.8	5.17	21.7	4.61	21.4	4.71	21.7	4.56	22.3	4.16
0 years Vo-Ag	21.3	5.12	22.3	5.48	21.9	5.20	22.5	5.31	22.6	4.92	23.0	4.73	22.9	4.01
1+ years Vo-Ag	20.2	5.28	21.2	5.45	21.7	5.16	21.2	4.06	20.4	4.30	20.8	4.20	21.8	4.29
Cumulative High School GPA														
All students	3.13	.57	3.16	.69	3.20	.49	3.23	.54	3.13	.56	3.17	.53	3.24	.48
0 years Vo-Ag	3.20	.62	3.19	.83	3.18	.48	3.24	.66	3.16	.59	3.26	.58	3.29	.48
1+ years Vo-Ag	3.20	.51	3.13	.53	3.22	.51	3.23	.46	3.11	.54	3.10	.49	3.19	.48

1984, a higher percentage of students who had not studied vocational agriculture in high school have entered the College of Agriculture with a unconditional status then entering students who had studied vocational agriculture in high school. In 1988, 88% of the entering freshmen who had not studied vocational agriculture in high school were admitted unconditionally compared to 78% of the entering freshman who had studied vocational agriculture in high school. Additionally, a higher percentage of students who had not studied vocational agriculture in high school met the foreign language requirements than those entering students who had studied vocational agriculture in high school. In 1988, 96% of the entering freshman who had not studied vocational agriculture in high school met the foreign language requirement, while 87% of the entering freshmen who had studied vocational agriculture in high school had met the foreign language requirement (Tables 1 and 2).

Table 5

Percent of Entering Freshman who Enrolled in Vocational Agriculture in High School

Number of Years in Vo-Ag	1982 (n=169) %	1983 (n=143) %	1984 (n=177) %	1985 (n=161) %	1986 (n=160) %	1987 (n=161) %	1988 (n=161) %
0 years Vo-Ag	52	46	50	39	48	44	52
1-2 years Vo-Ag	5	6	7	8	11	9	8
3-4 years Vo-Ag	43	48	43	53	41	48	40
1+ years Vo-Ag	48	54	50	61	52	57	48

There were also differences between the two groups in the type of courses used to meet the visual and performing arts requirement. A higher percentage of entering freshmen who had not taken vocational agriculture in high school met the visual and performing arts requirement with courses in art, drama, chorus, and band than students who had studied vocational agriculture in high school. The majority of the entering freshman who had studied vocational agriculture in high school met the visual and performing arts requirement with vocational agriculture courses in combination with or in the absence of courses in the usual visual and performing arts subjects.

The percentage of entering freshman who had studied vocational agriculture in high school in the highest quartile of their graduating class has been fairly consistent since 1982, ranging from a low of 57% in 1987 to a high of 64% in 1985 (Table 3). However, the percentage of entering students who had not studied vocational agriculture in high school in the highest quartile of their graduating class has increased from 45% in 1982 to 70% in 1987. There are no appreciable differences in mean ACT composite scores or cumulative high school grade point averages for students who had and had not studied vocational agriculture in high school.

CONCLUSIONS

The data indicate that the unconditional/conditional admissions policy announced in 1982 and implemented in 1984 has influenced the high school courses completed by students entering The Ohio State University College of Agriculture. Since 1984, a higher percentage of entering freshman have completed the requirements for English, mathematics, social science, science, visual and performing arts, and foreign language. Additionally, students ranked higher in their high school graduating class and scored higher on the ACT composite test.

Implementation of the admissions policy has not negatively influenced the percentage of freshman entering the College of Agriculture who had studied vocational agriculture in high school. Since 1984, the percentage of entering freshmen who are former vocational agriculture students has varied from 50% to 60%. The vast majority of entering freshmen who studied vocational agriculture in high school have completed three to four years of vocational agriculture.

Enrollment in vocational agriculture in high school does not have a negative impact on students meeting the admissions requirements for English, mathematics, social science, science, or visual and performing arts. Enrollment in vocational agriculture in high school does seem to have a negative impact on students fulfilling the admissions requirement for foreign language, and as a result, for students to meet the requirements for unconditional admission. However, the data clearly indicate that students who enroll in vocational agriculture in high school can complete college preparatory courses required for unconditional admission and that differences in academic preparation among vocational agriculture students and non-vocational agriculture students are diminishing.

A majority of entering freshmen who had studied vocational agriculture in high school met the requirement for courses in visual/performing arts through a combination of traditional courses in visual and performing arts and vocational agriculture courses or by substituting vocational agriculture courses for courses in art, music, drama, or chorus.

IMPLICATIONS

For the particular state and university to which the data pertain a major implication is that vocational agriculture teachers, state supervisors, teacher educators, vocational agriculture students and their parents, school administrators, and school guidance counselors need to be aware that enrollment in vocational agriculture in high school does not necessarily prevent students from completing a college preparatory curriculum. Current vocational agriculture students, as well as prospective vocational agriculture students, need to know that enrollment in vocational agriculture in high school does not prohibit them from completing the requirements needed for unconditional admission to The Ohio State University. Counselors and teachers need to advise vocational agriculture students to plan their high school course of study in order to maximize the students' chances of meeting admission requirements. This is especially true in the case of the foreign language requirement. Counselors and vocational agriculture teachers need to be aware that vocational agriculture students tend to depend on enrollment in vocational agriculture to satisfy the visual and performing arts requirement. A majority of entering freshman who presently are unconditionally admitted would fall in the conditional admission category, if the university chose not to accept vocational agriculture as meeting the visual and performing arts requirement.

Implications of this study also are applicable beyond one particular state, since educational reform is being implemented across the country . Generally these reforms reflect an increased emphasis on a college preparatory curriculum in high school and on higher admission standards to universities and colleges, including colleges of agriculture. Agricultural educators need to inform students and their parents, school administrators, and school guidance counselors that enrollment in vocational agriculture in high school does not necessarily prevent students from completing a college preparatory curriculum. Another general implication is that research is needed to assess the relationship between the extent to which entering students complete a required college preparatory curriculum in high school and their achievement in college, including achievement in colleges of agriculture.

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THE RELATIONSHIP BETWEEN THE PROFESSIONAL EDUCATION COMPONENT OF THE AGRICULTURAL EDUCATION CURRICULUM AND GRADUATE CAREER CHOICE

DISCUSSANT REMARKS

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The title of this paper suggests that it seeks to study any relationships between the professional preparation of teachers and whether they enter teaching. The authors are to be commended for pursuing a question of importance to all of teacher education. The following remarks are based on the paper supplied to the reviewer several weeks prior to the presentation.

The research paper was well organized. Clearly stated purpose and objectives appeared to be well supported by a well articulated theoretical framework. However, several questions with regard to methodology arise as one reads the paper.

The title of the paper states that the study investigates "the relationship between" professional education and career choice. The design section of the paper indicates that the study is a "descriptive-correlational study." However, the statement of purpose suggests that the study was to "determine if" certain factors "influenced" career choice. Further, the objectives sought to "determine the extent to which" these factors "might distinguish between graduates." While the title and methods section indicate that the study is a correlational design, phrases in the purpose and objectives would indicate that the authors seek to establish causation. (One can refer to Webster's (1972) dictionary to find that the prevailing definition of the term "influence" is to produce "effect.") The study then uses discriminant analysis as a statistical design. Discriminant analysis is, according to Pedhauzer (1982, p. 692), consistent with causal-comparative studies which generally attempt to determine causation rather than relation. Why then does the title and design section of the paper indicate that the study is a correlational design? Perhaps a study which determines that student teaching grade and certification status (as independent variables in this design) are somehow associated with liklihood to teach (the dependent variable) is best done through a simple correlational model. To suggest that one set of factors "causes" the other in this case may be a tremendous leap of faith, especially since one could as easily posit that an alternative independent variable -- desire to teach -- could affect student teaching grade and certification status (which would then become dependent variables). The best positivistic design one could hope for in a study addressing these factors is correlational. The practical question, "What influenced you to enter teaching (or not)?" may best be answered by simply asking the subjects.

Let us turn to some housekeeping with regard to methodology. The conclusions section of the paper indicates that 90% of the subjects were certified. This variable was one of the most significant with relation to the dependent variable. How does such a high proportion affect the statistical analysis? A canonical correlation coefficient was reported in table 6. According to Pedhauzer (pp. 720-721) this measure is used with multiple dependent variables. This study was interested in only one dichotomous dependent variable, career choice. A printing error eliminated the bar from the symbols for all the means.

COGNITIVE LEVELS OF INSTRUCTION AND STUDENT PERFORMANCE IN SELECTED COLLEGE OF AGRICULTURE COURSES
DISCUSSANT REMARKS

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The preparation of students to use higher intellectual skills is indeed a significant and worthy educational objective, especially in light of the plethora of educational reform movement reports calling for such action. Institutions and instructors who seek to develop such educational programs should begin with studies which describe the status of present educational programs with regard to these skills. The investigators in this study are to be commended for attempting to do that. If all educators at all levels will conduct similar foundational investigations, the potential for impact through change in all of education is immense.

The report of this study, on which these discussant remarks are based, was well-written. The theoretical framework based on the literature lead to a clear statement of purpose and objectives. The procedures were appropriate and reported in a fashion which would make replication relatively easy.

Several questions do arise as one read the report. The study sought to describe the cognitive level of experiences and cognitive level of performance among students at a four year college of agriculture. Why were only introductory courses chosen? Might one assume that introductory courses are largely informational in nature and do not expect higher level functioning, as the findings indicated?

What was the population under study? Was it the 127 students enrolled in the four courses, or was the study of four case classes? Many of the findings are presented by describing the classes across the factors.

By what procedure did observers identify each "instructor behavior" to rate them on the instrument? What is an "instructor behavior?"

"Comprehension" is identified as the second level of cognition and is discussed in the text of the findings. This term is not used in the tables. However, new terms "translation" and "interpretation" are in the tables and the reader must assume that they comprise comprehension. This is not a minor inconsistency considering that as much as 41 percent of the findings in one table are included in these categories.

The report concludes that "no aspect of instruction was clearly related to student cognitive performance...." However, it goes on to recommend that greater efforts should be made in teaching courses at the higher cognitive levels. Why?

Overall, the report was a very good presentation of a well-done study. Attention to the aforementioned questions would aid the reader in synthesizing, evaluating and applying the information.

THE IMPACT OF INCREASED ADMISSION REQUIREMENTS ON STUDENTS' ACADEMIC CREDENTIALS UPON ENTRY TO A COLLEGE OF AGRICULTURE

DISCUSSANT REMARKS

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The consideration of increased university admission requirements and participation in high school vocational programs is an important concern for members of the agricultural education profession. These researchers attempt to further illuminate that discussion and, through this study, have a paper that is both timely and significant.

The study sought to describe how admissions policy "influences" student credentials and to explore the "extent to which" enrollment in high school vocational agriculture impedes or enhances students in completing a college preparatory curriculum. A "population" of college freshmen over a period of seven years was studied in, what the authors describe as, a "descriptive" study. Data were presented in the form of percents, means and standard deviations.

The reader should be alerted to several questions in what is otherwise a very clean yet simple design. Both the problem statement and the objectives use the word "influence." According to Webster's dictionary (7th New Collegiate, 1972) this term implies to produce an "effect." Can a descriptive design accomodate objectives which imply causation or, at the least, relation? The analyses utilized no statistical measures of relation or causation, appropriately so in a population study. The authors should consider the use of an alternative term.

Table 4 is a set of sample means and standard deviations. The authors note that a "population" was studied. Since sample statistics were used in this population study, is the reader to assume that each of the means reported represent specific samples of the population?

Tables 3 and 4, and the related text of the findings, report data on high school class rank, credits earned, ACT scores, and high school GPA. Since the objectives do not address these factors, why are they reported?

Some differences between students according to whether they had completed high school vocational agriculture were noted. This census study correctly reported these differences as percentages. However, the reader is left to wonder if the objective of determining influence is a correct conclusion, based on the design of the study.

In conclusion, the study addresses an important question for agricultural educators. The authors should be recognized for their contribution to the profession.

A NATIONAL SURVEY OF TWO-YEAR POSTSECONDARY INSTITUTIONS TO DETERMINE SELECTED AGRICULTURE PROGRAM CHARACTERISTICS

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PROBLEM STATEMENT

In an effort to restructure the delivery of Minnesota Technical College programs, the Minnesota Board of Vocational Technical Education has embarked on a project to convert the educational programs offered by its 30 institutions from a clock-hour based system to one based on course credits. Concurrently, the Board has also implemented projects to standardize curriculum within program areas. The Division of Agricultural Education at the University of Minnesota was asked by the Board to take responsibility for the task of developing a standardized state curriculum guide for all agriculture programs offered within the Technical College System.

In developing these state curriculum guides, the project staff was asked to think critically and creatively about the future needs of students and industry. There was also a directive to determine the status of two-year postsecondary agriculture programs so that the new curriculum guides would reflect current trends while still allowing for future needs and developments. Structuring programs to reflect current and/or future trends requires that decisions be made regarding such characteristics as program lengths, type of degree or diploma to be offered, program titles, course content and length, and the appropriate balance of technical education courses with general education courses.

While data were available regarding the current status of two-year postsecondary agriculture program characteristics in Minnesota, there was a definite lack of such information on a national level. If agriculture programs in Minnesota Technical Colleges were to be a reflection of "cutting edge" curriculum design, then comparative national data were needed. Because these data were not readily available, it was determined that a national study should be undertaken in order to establish a reference base against which postsecondary technical agriculture programs could be compared so as to ensure they reflect current practice and thinking.

OBJECTIVES

The primary purpose of this study was to determine the current status of selected agriculture program characteristics in two-year postsecondary institutions in the United States.

Specific objectives of this study were to:

1. Identify the general categories of agriculture programs offered by two-year postsecondary institutions.
2. Identify the types of degrees or diplomas offered by agriculture programs in two-year postsecondary institutions.
3. Determine the lengths of agriculture programs in two-year postsecondary institutions according to credits or clock-hours.
4. Determine the proportion of general education courses to technical courses in agriculture programs offered by two-year postsecondary institutions.

Throughout this paper, the following definitions will be used:

1. Associate in Arts (AA) Degree refers to an academic title awarded to graduates of two-year postsecondary programs in which the primary goal of the programs is to provide a broad liberal arts and sciences background (Minnesota Higher Education Coordinating Board, 1986, p. 9).
2. Associate in Science (AS) Degree refers to an academic title awarded to graduates of two-year postsecondary programs in which the goals of the programs are to provide a liberal arts and sciences background and also to provide the foundation for baccalaureate programs with highly structured lower division requirements (Minnesota Higher Education Coordinating Board, 1986, p. 10).
3. Associate in Applied Science (AAS) Degree refers to an academic title awarded to graduates of two-year postsecondary programs in which the goal of the programs is to prepare people for employment (Minnesota Higher Education Coordinating Board, 1986, p. 11).
4. Diploma or Certificate refers to the recognition given to graduates of those programs which do not offer AA, AS, or AAS degrees. Such programs can be highly variable in length and are intended primarily to prepare people for employment or to provide occupational updating.
5. General Education refers to educational experiences that provide for the development of competencies in communications, social sciences, humanities and fine arts, analytical and inferential reasoning, and computational skills, as well as the ability to learn on one's own (Minnesota Higher Education Coordinating Board, 1986, p. 5).
6. Technical Education refers to educational experiences that provide for the development of competencies needed in an occupation or cluster of occupations.
7. Clock-hours refers to a process for certifying the completion of an educational experience. In this process, a student is credited according to the actual number of hours a student is expected to invest in the experience.
8. Credit refers to a measurement, based on some predetermined formula, for estimating the amount of time a student is expected to devote (both inside and outside of the classroom) to an educational experience.

RELATED LITERATURE/THEORETICAL FRAMEWORK

The literature specifically related to postsecondary agriculture programs is disappointingly small. While it can be expected that research in other areas of agricultural education can be adapted or transferred to postsecondary agriculture education, it also seems realistic to expect that there are unique features of postsecondary programs that require their own research base.

A review of literature regarding postsecondary agriculture programs during the last 10 years shows that the limited amount of research that has been done has focused primarily on articulation with secondary programs (DeWerff, 1982; Harrison & Haynes, 1982; Lee, 1983; Welton, 1982), in-service education for postsecondary agricultural educators (Ingram & Field, 1979; Thompson, 1984; Welton, Foster, Mokma, Cvancara, & Byers, 1981), business/industry partnerships (Fuller, 1978; Wessman, 1978), and SOE (Birkenholz & Holmberg, 1984; Burke, 1984; Janke, 1984; Leuenberger, 1984). Although these studies have contributed to the knowledge base of postsecondary agriculture programs, they did not focus on characteristics of programs that were applicable to this study.

Efforts to establish a basic research base regarding the status of postsecondary agriculture programs on a national basis have focused primarily on the identification of programs, names and numbers of programs, numbers of instructors, numbers of students, staff development, and agricultural work experience required for faculty (Mokma, 1979, 1986; Garrison, 1982). Research regarding the lengths of programs, types of degrees or diplomas awarded, and specific course content (technical education and general education course requirements) is generally not available unless one contacts individual programs or institutions. The need for a base of information regarding characteristics of postsecondary agriculture program structure is important for developing and implementing program standards against which new and existing programs can be compared. In a report from the Task Force to the National Council on Vocational and Technical Education in Agriculture (1986), it was recommended that the National Council establish a "standards" project to address a variety of issues. One of these issues was the need for national research to determine the instructional needs for students, programs and methods. The issue of relevant curriculum was also identified as an area that needed to be addressed. A national study of postsecondary agriculture programs to identify the characteristics of program length, degrees or diplomas awarded, and nature and balance of courses required would provide a significant knowledge base against which to develop program standards. It would also provide a base for comparing course requirements and structure between programs.

METHODS

This study was a descriptive survey of the population of two-year postsecondary institutions in the United States which offer agriculture programs. A mailing list which was used for the National Conference for Leaders in Postsecondary and Adult Education in Agriculture and Natural Resources served to frame the population. This conference, which was held in October of 1986 in

Kansas City, Missouri, utilized a mailing list which was based on the 1986 Directory of Postsecondary Programs in Agriculture and Natural Resources Occupations (Mokma, 1986). Conference planners also added institutions to this list based on information received from postsecondary agriculture educators across the country. Consequently, this conference mailing list was considered to represent the population of postsecondary institutions in the country with agriculture programs. The frame was composed of 678 postsecondary schools.

Each institution on the mailing list was sent a letter from the Division of Agricultural Education at the University of Minnesota requesting that it provide information regarding the agriculture program names or titles, specific courses or requirements needed to complete each program, and the degree or certificate received by program completers. Because it was believed that most of this information would be found in each institution's general school catalog, the primary request from the researchers was for a copy of the school catalog.

The first mailing was sent in September of 1987. A follow-up to non-respondents was made approximately six weeks later. No follow-up was made of the non-respondents remaining after the two mailings due to budgetary and time constraints.

The research team developed a process for interpreting the data presented in the catalogs. This process was developed because some subjective decisions had to be made regarding selected program characteristics, such as which courses were general education versus technical education. One researcher then reviewed all of the catalogs and categorized the information so as to insure that the data were consistent. The data gathered from the survey were organized and entered into database files. Finally, procedures were developed to access the needed information from the computer database files.

RESULTS

Responses were received from 443 postsecondary institutions. Of these, 43 noted that they had discontinued or had not previously offered agriculture programs. Two institutions indicated that their program offerings were listed under catalogs received from other institutions. Therefore, the useable responses totalled 398, resulting in a response rate of 58.7%.

A total of 1507 individual agriculture programs were identified from the survey data. (There are many more programs than responding institutions because most institutions have several agriculture programs.) These were then organized into 34 general categories. These categories were agribusiness, agricultural education, production agriculture, forestry, horticulture, landscape/turfgrass, agronomy, animal science, food science, grain science, natural resources, agricultural mechanics, pest management/entomology, dairy science, floristry management, nursery management, horse production, adult farm management, agricultural economics, soil science, veterinary medicine, animal health technology, irrigation technology, agricultural engineering, farm management training, beef production, swine production, agricultural buildings,

fruit and vegetable production, range management, agricultural marketing, poultry production, sheep production, and other (for those programs which were combinations of the above). These 34 program categories are ranked in Table 1 according to the numbers of programs within each area.

Table 1

Program Ranking According to Number of Respondents in each Category

Ranking	Program Category	Number of Programs
1	Production Agriculture	188
2	Agribusiness	174
3	Horticulture	157
4	Landscape/Turfgrass	126
5	Agricultural Mechanics	114
6	Forestry	98
7	Animal Science	77
8	Farm Management Training	67
9	Horse Production	58
10	Agronomy	56
11	Floristry Management	51
12	Natural Resources	41
13	Animal Health Technology	33
14	Veterinary Medicine	33
15	Dairy Science	31
16	Nursery Management	31
17	Adult Farm Management	26
18	Agricultural Education	14
19	Food Science	14
20	Pest Management/Entomology	14
21	Soil Science	11
22	Land/Range Management	10
23	Agricultural Economics	9
24	Fruit/Vegetable Production	9
25	Swine Production	9
26	Beef Production	7
27	Agricultural Engineering	6
28	Grain Science	5
29	Irrigation Technology	5
30	Agricultural Buildings	3
31	Sheep Production	3
32	Agricultural Marketing	2
33	Poultry Production	2
34	Other	23
	Total	1507

Because of the large volume of data that were obtained for each of the 35 identified program areas, it is not feasible to list all of the results in this paper. (Data for the other programs are available from the researchers.) However, a review of the results for three of the larger program areas gives an indication of the types of conclusions that can be drawn from the national survey database.

Production Agriculture

Production agriculture programs totalled 188. Credit-based programs on a quarterly calendar ranged in length from 34 to 144 credits. Credit-based programs on a semester schedule ranged from 21 to 76 credits in length. No attempt was made to determine an average number of credits per program because it was evident from the data that schools were not using standard unit criteria for determining course credit (e.g., some schools require only 68 quarter credits for an AAS degree while others require over 144 quarter credits to receive the same degree). Clock-hour based programs had a range of 2160 to 2340 hours in total length. Of the 188 production agriculture programs, only 3 (1.6%) were operating on a clock-hour system.

For production agriculture programs, the most common degree awarded was the AS (Associate in Science) degree (33.5%), with the AAS (Associate in Applied Science) degree being granted by 28.2% of the programs, the AA (Associate in Arts) degree being awarded by 21.3% and diplomas or certificates given by 17.0% of all programs. It is evident that over half of the production programs are designed to allow transfer to four-year degree granting institutions.

The proportion of general education to technical education for production agriculture programs is 51.1% for AA degrees, 48.0% for AS degrees, 19.9% for AAS degrees and 0% for diploma or certificate programs. Tables 2 and 3 summarize the characteristics of the production agriculture programs.

Table 2

Production Agriculture Program Credit/Clock-hour Requirements

Calendar System	Requirements
Semester	21-76 credits
Quarter	34-144 credits
Clock-hour	2160-2340 hours

Table 3

Types and Numbers of Degrees Offered and Proportion of General Education for Production Agriculture Programs

Degree/Diploma	No. of Programs	%	Proportion (%) of Gen. Ed.
AS	63	33.5	48.0
AAS	53	28.2	19.9
AA	40	21.3	51.1
Diploma	32	17.0	0.0
Total	188	100.0	----

Note. All Percentages rounded to one decimal place.

Agribusiness

On a national level, 174 agribusiness programs were identified. They ranged in length from 7 to 91 credits for those schools on a semester system and from 32 to 142 credits for those institutions on a quarter system. Of all institutions offering agribusiness programs, only four (2.3%) were doing so on a clock-hour basis. Program lengths for clock-hour based programs ranged from 1434 to 2340 hours.

The most prevalent type of degree offered to program completers was the AAS degree. This degree was offered by 59.1% of all programs. A diploma or certificate was awarded by 17.1% of the agribusiness programs. The AS degree was granted by 14.8% of the programs while the AA degree was given by 7.4% of agribusiness program respondents. Given the nature of the degrees and diplomas granted by agribusiness programs, it is evident that over two-thirds are terminal programs, indicating that they are not necessarily intended for students planning to transfer to four-year institutions.

The approximate proportion of general education courses to technical agriculture courses was 46.5% for AA programs, 35.3% for AS programs, 19.7% for AAS programs and 0% for diploma and certificate programs. Tables 4 and 5 highlight the agribusiness program characteristics.

Table 4

Agribusiness Program Credit/Clock-hour Requirements

Calendar System	Requirements
Semester	7-91 credits
Quarter	32-142 credits
Clock-hour	1434-2340 hours

Table 5

Types and Numbers of Degrees Offered and Proportion of General Education for Agribusiness Programs

Degree/Diploma	No. of Programs	%	Proportion (%) of Gen. Ed.
AAS	105	60.3	19.7
Diploma	30	17.2	0.0
AS	26	15.0	35.3
AA	13	7.5	46.5
Total	174	100.0	----

Note. All percentages rounded to one decimal place.

Landscape/Turfgrass

Landscape/turfgrass programs identified by the study numbered 126. Landscape/turfgrass program lengths ranged from 15 to 122 credits for those on a quarterly system to 8 to 72 credits for those on a semester system. Programs on a clock-hour basis, of which there were only four (3.2%), had lengths of 1080 to 2340 hours.

Landscape/turfgrass programs were most commonly diploma or certificate programs (49.2%). AAS degrees were granted by 31.8% of the programs while 19.1% of the programs awarded AS degrees. None of the landscape/turfgrass programs in the study granted AA degrees.

Of those programs awarding diplomas to completers, only 3 of the 62 required any general education courses. AAS degree landscape/turfgrass programs had an average proportion of 23.4% general courses of the total required courses. AS degree programs, meanwhile, had a mean general education requirement of 28.2% of the total program curriculum. These characteristics of landscape/turfgrass programs are highlighted in Tables 6 and 7.

Table 6

Landscape/Turfgrass Program Credit/Clock-hour Requirements

Calendar System	Requirements
Semester	8-72 credits
Quarter	15-122 credits
Clock-hour	1080-2340 hours

Table 7

Types and Numbers of Degrees Offered and Proportion of General Education for Landscape/Turfgrass Programs

Degree/Diploma	No. of Programs	%	Proportion (%) of Gen. Ed.
Diploma	62	49.2	--
AAS	40	31.7	23.4
AS	24	19.1	28.1
AA	--	--	--
Total	126	100.0	----

Note. All percentages rounded to one decimal place.

The agribusiness, production agriculture, and landscape/turfgrass programs were used to illustrate examples of basic results obtained from this study. Results were obtained for each of the 34 program categories. In addition, results were also tabulated regarding the type of institutions programs were located in (e.g., technical school/institute, technical college, community college, junior college, etc.). As one might have expected, most programs were located in community colleges.

CONCLUSIONS

In consideration of each objective, a number of conclusions were made.

Objective 1. Identify the general categories of agriculture programs offered by two-year postsecondary institutions. Conclusions were:

(a) A wide range of categories exist for agriculture programs in two-year postsecondary institutions across the United States.

(b) Agriculture program categories range from specific specializations to broad general titles.

Objective 2. Identify the types of degrees or diplomas offered by agriculture programs in two-year postsecondary institutions. Conclusions were:

(a) The type of degree or diploma most commonly offered varies from program to program.

(b) Degrees are more frequently offered than are diploma. Across all program categories, the AAS degree is the most popular degree offering.

Objective 3. Determine the lengths of agriculture programs in two-year postsecondary institutions according to credits or clock-hours. Conclusions were:

(a) The vast majority of programs are credit-based rather than clock-hour based.

(b) Program length varies greatly within and across program titles.

Objective 4. Determine the proportion of general education courses to technical courses in agriculture programs offered by two-year postsecondary institutions. The conclusion was:

(a) The proportions of general education vary considerably within and across degree types.

IMPLICATIONS

It is evident that post-secondary technical agricultural education has great variation within states and across states. Much of this variation occurs in program lengths and type of degree or diplomas awarded. Further research is warranted regarding the effects of these factors on job placement, technical skill preparation, and earnings of graduates within specific program areas. For example, it might be interesting to study the qualities of graduates from diploma, AAS, and AS degree agribusiness programs to determine if there are differences in salaries, student perceptions, employer perceptions, and/or future job mobility. Such a study might help determine which program options best meet student needs.

The proportion of general education to technical education is very diverse between degree programs (both within and across the various program areas). These data should serve to stimulate discussion regarding the appropriate blend of general education and technical education within the different degree and diploma options. Perhaps for the first time, there are comparative data available which document the wide differences existing in this area. Future discussion regarding "standards" for postsecondary agriculture programs may wish to address these differences. Although most two-year agriculture programs are not intended to be transfer programs, research data suggest that students from terminal vocational programs do indeed transfer to four-year degree granting institutions. It seems reasonable to assume that the issue of transfer is affected by the proportion of general and technical education within two-year postsecondary agriculture programs.

Perhaps the most important implication of this study is that it can serve as a first step in the development of a source of data which can be used to stimulate meaningful discussion regarding the nature of postsecondary agriculture program structure and quality. Much of the discussion in the past has been undertaken without a clear grasp of many of the descriptive characteristics of programs described in this study. These data can serve as a basis for guiding program restructuring and program development efforts.

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FARMER PERCEPTIONS OF SOIL AND WATER CONSERVATION ISSUES: IMPLICATIONS TO AGRICULTURAL & EXTENSION EDUCATION

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"Soil erosion is a serious threat to America's long-term agricultural productivity" (Turner, 1983, p. 14). The United States Department of Agriculture (USDA) Soil Conservation Service (SCS) estimates that at least 25 percent of all cropland in the United States suffers severe wind and water erosion. Farming practices have led to soil losses exceeding 50 tons per acre in some cases and more than 5 tons per acre nationwide (Turner, 1983).

Today, there are many concerns in rural and urban sectors about the threat to natural resources because of agricultural production practices; ie. use of chemicals affecting the quality of life (Hallberg, 1986; Baker, 1985; Padgitt, 1987; Lasely, 1988). However, the use of chemicals has added to that quality of life by helping to provide an abundance of food products and reduce the drudgery of farming. Through the use of chemical fertilizers, herbicides, and pesticides, farmers are able to produce a reliable source of affordably-priced food, which has enhanced the quality of life for the urban consumer (Padgitt, 1987).

Across the corn belt, the average nitrogen application rate increased from 45 pounds per acre in 1965 to 143 pounds per acre in 1984 (Hallberg, 1986). The total risk of nitrate contamination is not yet fully understood. Most of the wells that have excessive amounts of nitrate are less than 100 feet deep. The nature of percolation of nitrates appears to be leaching the pollutant to greater depths (Kelley, 1986a).

Pesticides are used by farmers on over 90 percent of the corn and soybean fields in the midwest (Freshwater Foundation, 1986). In one state, farmers applied more than 59 million pounds of pesticides in 1982 (Kelly, 1986b). In general, most soybean and corn fields receive two pounds of pesticide chemicals each and every year (Freshwater Foundation, 1986).

Pesticides enter the groundwater through spills, poorly managed wells, improper disposal of wastes and containers, through agricultural drainage wells, sinkholes, and movement through the soil's profile (Hallberg, 1986). Groundwater is the only source of drinking water for 97 percent of the rural population in the United States.

Groundwater contamination by pesticides has become a major concern for many rural people. Sixty-one percent of the Iowa farmers recently surveyed by Lasley (1988, p. 1) indicated that "...greater regulation is needed in the use of chemicals in agriculture." Sixty-three committee. Questions were designed to assess the perceptions regarding issues in soil and water conservation, analyze the perceptions of management practices, analyze the perceptions of the respondents regarding the severity of water quality and erosion in geographical areas within the state, and determine the usefulness of various sources of information. The remaining items dealt primarily with demographic variables which were used to establish a profile of commissioners and non-commissioners in the state but due to length is not the focus of this report. The questionnaire was put into a booklet format.

The instrument was refined through consultation with an advisory committee consisting of educators and soil conservation leaders. Post-hoc reliability tests, using Cronbach's alpha procedures, were used to determine the reliability of the scales in the instrument. The composite reliability coefficient for the instrument was determined to be .84.

The population of the study consisted of Iowa soil conservation district commissioners (500) and all other farmers in Iowa (109, 367) as determined by the Agricultural Stabilization and Conservation Service. The two groups served as sources for the study's sample. One group was comprised of one-half of the Iowa soil conservation district commissioners (250). A second group consisted of 481 non-commissioners (ASCS determined farm operators) selected at random. The samples were stratified and proportioned, respectively (commissioners and non-commissioners) so as to have a representative group of respondents. A total of 432 usable responses were received, which formed the basis for the statistical analyses.

Parametric and nonparametric statistical procedures were employed to analyze and summarize the data. Frequency counts were used to rank order nonparametric items, while means and standard deviations were used to compare the responses of respondents when grouped by selected demographic variables. Pearson Product Moment Coefficients were computed to determine the relationship between the overall score on the selected perception categories and the demographic data. All the analyses were conducted to answer the specific objectives of the study.

FINDINGS

The general perceptions of the respondents included a strong indication of the need for improved education toward the management of agricultural chemicals and their use. Four out of the top five rated perception statements dealt with this issue (Table 1). The respondents' preference was for education which was straightforward and precise. This finding corroborates the information found by the Freshwater Foundation in 1987. The foundation's study reported that 57 percent of the respondents indicated the greatest need was for more information dissemination (education) regarding agrichemical management and protection of groundwater. It appears that the respondents (commissioners and non-commissioners) were much more percent of these same farmers indicated that "...government should impose stricter testing of chemicals before they are released."

According to an Environmental Protection Agency report, seventeen different pesticides in low concentrations have been found in groundwater in 23 states. The most often found pesticide was the corn herbicide, atrazine, and its chronic long-term effects in drinking water are unknown. Drinking water that is contaminated may be hazardous to human health (Freshwater Foundation, 1986; Hallberg, 1986).

In analyzing these issues, there are a number of critical questions that need to be addressed. Are farmers ready to reduce the application rates of nitrogen in order to protect groundwater? What are the factors that interfere with decisions to reduce nitrogen application (ie. tradition, cost/profit, commerical fertilizer tests, grower pride)? What role can education play in helping farmers make more informed decisions? What specific management techniques do farmers need to follow to more effectively manage pesticides, fertilizers, soils and water?

PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of this study was to identify and analyze the perceptions of soil conservation district commissioners and other farmers regarding selected soil and water conservation practices. A secondary purpose was to identify the implications of these perceptions and characteristics to educational practice and develop an educational model based on this study and its review of literature. The specific objectives of the study were as follows: 1) Identify the perceptions held by farmers regarding the use of chemicals and reduced-tillage practices, 2) Identify the resources farmers use in acquiring information about chemicals, pesticides, fertilizers, and tillage.

METHODS AND PROCEDURES

The study was the result of a need expressed by the Iowa Association of Soil Conservation District Commissioners. The need for use on developing a descriptive analysis of current perceptions of soil conservation district commissioners and non-commissioners (farmers) in the state of Iowa concerning issues in soil and water conservation. The study involved cooperation between the researchers and the Department of Agricultural Education at Iowa State University, the President of the Iowa Association of Soil Conservation District Commissioners, Iowa State Agricultural Stabilization Conservation Service (ASCS), members of the researcher's advisory group, soil conservation district commissioners, and farmers in the state of Iowa.

The study had a descriptive-correlational design. A survey questionnaire was used to collect the data using a Likert-type scale. The survey instrument was developed based upon previous research conducted in this area and input from the researcher's advisory concerned about chemical management and water quality than they were about soil erosion.

The top ranked perception item by both groups (commissioners and non-commissioners) was that farmers might have benefited from the Conservation Reserve Program (CRP) even though these same farmers might have cause the problem in the first place. Governmental farm programs are based upon solving national needs and are arbitrary in nature. Many farmers would like to have farm program control at the local level. Farmers see what is occurring on their neighbor's fields. Thus, if it were left up to them, exemptions would be made on the local level to excluse individuals from the program.

The relatively low ranking of items relating to banning Atrazine and reducing nitrogen fertilizer use indicates dependence upon these substances. The respondents indicated they agreed to some extent that farmers apply too much fertilizer per acre. It is interesting to note that the total response from both groups indicated they did not agree that the rules for the Food Security Act should be relaxed. The commissioners were more strident in their dislike of this action than were the non-commissioner group. This finding concurs with the response by Guliford (1988) to Congress. He indicated farmers had accepted the rules of the Food Security Act and they were willing to live with the rules and to modify those rules would weaken the total programming effort at the local level.

As a result of the 1987 water quality legislation in the state of Iowa, pesticide container must have warning labels to inform users of potential dangers and contamination possibilities. The respondents indicated they did not feel this was an effective method of transferring information. The rush of field work by farmers in a typical spring season provides them with little opportunity to read container labels. A more effective procedure would be to teach the chemical dealers to do a thorough job of training their employees and farmers about the dangers and contamination potential of chemcials.

The moderate ratings of statements concerning reducing nitrogen fertilizer rates, pesticide use in conservation tillage and higher chemical application rates with reduced tillage systems indicated slight agreement with these concepts but secondary to the education and fairness of government farm programs.

The respondents' rankings of the management practices indicated farmers were supportive of altering plants to make them resistant to insects. This finding would support Lasley and Bultena's (1988) study which concluded farmers were increasing their support of alternative agricultural production methods because they rated runoff of pesticides and fertilizers the number one pollutant in the state of Iowa. Francis et al. (1988) indicated breeding crops for insect resistance could drastically reduce the need for pesticides. Computer systems that could monitor and analyze fertilizer needs was another concept that would be supported by farmers based on the findings of this study. However, livestock manure pits and the use of personal computers were not as highly supported. The least supported concept was to add chemicals to treat water to neutralize contaminants.

In general, most of the respondents rated erosion and water quality a serious problem statewide, as well as in their own area of the state. However, they rated the problem less severe in their own neighborhoods. This finding supports the "proximity effect" other studies have shown. The proximity effect means a person may acknowledge a problem exists in general, but may not admit its existence in the individual's own situation. Korsching et al. (1985) and Padgitt and Prior-Miller (1985) were able to document the existence of the proximity effect in Iowa. The commissioners acknowledged erosion and water quality were greater problems than did the non-commissioners. This finding is an indication that the apparent awareness and interest that the commissioners possess must be a factor in the overall educational program.

The findings that field demonstrations (tours) and county meetings were the highest rated two items was significant with many implications for the process of the diffusion of new information and technology. Martin and Omer (1988) reported that Iowa young farmers indicated that local community meetings were the most important of the selected methods used by extension. Demonstration plots of alternative agriculture were of high interest to local farmers in a Nebraska study (Francis, 1988). This interest was attributed to a sense of community participation and ownership. Based upon these findings, educational specialists should incorporate these two techniques into conservation program planning strategies. Magazines were ranked third. This finding is not congruent with Mushambi's study (1985). He found that magazines were the most useful source of conservation information. Striegler (1987) also found magazines to be the most useful source of information. The fact that respondents (commissioners and tours to be the most useful source of information. The fact that respondents (commissioners and non-commissioners) in this study selected field demonstrations and tours to be the most useful source of information appears to support The Freshwater Foundation's (1987) analysis that farmers trust information from other farmers more than other sources of information. This finding concurs with the study of Stiegler (1987). Radio and TV (video tapes were the lowest rated sources of useful information. Little has been done with these forms of media in the area of conservation education. It is surprising that on-farm consultation was the lowest ranked source for information. This finding might be attributed to the lack of on-farm consultation by conservation and education professionals as indicated by Korsching and Nowak (1983). Printed materials, trade shows and fairs, and visual materials were ranked at a moderate level compared to the highest rated items: usefulness of tours, meetings, and magazines.

The Soil Conservation Service was ranked as the most useful human resource for information. This information corroborates the findings by Mushambi (1985) and Korsching et al. (1985) that the Soil Conservation Service was the most useesful source for information. The county extension service was also a useful source for information.

The vocational agriculture instructors were somewhat useful as sources of information. Some machinery manufacturing companies have been successful in promoting the moldboard plow as "conservation tillage implement" (Korsching et al., 1985). It was somewhat surprising that seed/fertilizer/chemical dealers were perceived to be the fourth most useful human resource for information relating to conservation. It could be conjectured that since many aspects of conservation tillage are dependent upon specific knowledge possessed by technical chemical specialists, the users of these systems rely heavily upon the technical chemical specialists, the users of these systems rely heavily upon the retail distributor of pesticides for information concerning use and application. Information from neighbors and friends was useful but at a moderate level. The soil conservation district commissioners were useful but not at a high level. This finding is supported by the finding by Mushambi (1985) which indicated that commissioners were low on the list of useful information sources.

Education Model

The findings of this study have implications for technical experts, education specialists, district commissioners, farmers, and researchers in the area of soil conservation and water quality in Iowa.

The complex problem associated with development and planning of educational programs with diverse interests of all groups involved, requires that a comprehensive approach be devised. If education is a key to solving problems in conservation, it appears that a model for delivery of education should be developed. Therefore, it would be advisable to form a planning comittee to take into account all perspectives as a plan is being developed and implemented. The committee would have representation from the following agencies and groups: Iowa Association of Soil Conservation District Commissioners, Soil Conservation Service, Extension Service, Agricultural Stabilization and Conservation Service, farmers and farm groups, agricultural educators, and farm-based research specialists. The committee would assist with the revision and implementation of the proposed soil and water conservation educational system (Figure 1).

The findings of this study, the review of literature, and researcher experience suggest that a total unified strategy should be developed in order to solve the environmental problems of erosion and water quality. The foundation for the model is a three-stage approach to be used for implementation of a field-based adoption/diffusion strategy. The overall model is based upon the involvement of the farmer and education specialists working as a team striving to develop sensible solutions to environmental management. A basic assumption of the model is that soil and water conservation information is accurate and available. In stage one, input from farm groups would be utilized through the use of a needs assessment survey to develop baseline information upon which the educational program would be formed. In stage one, it would be important to identify the innovators and encourage their participation. It would be important to get to the specific felt and ascribed needs of the residents in the total community. Formal and nonformal information-gathering techniques should be used. Through this process, information from farmers, research studies, government regulations and agencies, and an advisory group would be gathered. Program facilitation would come from the following groups: educational professionals, Soil Conservation Service, county and state extension specialists, soil conservation commissioners, agricultural educators and farmers. Interest in proposed programs would be developed through the use of the media such as: personal contacts, letters, advisory group contact, newspaper articles and radio programs.

Based upon the findings of this study, the program methodology would include field demonstrations where farmers could see conservation systems in action. Specific demonstrations would include various tillage systems with various rates of chemicals. It would be necessary to repeat these demonstration plots in a number of random locatoins inorder to be able to generalize the results for the county or township population. County meetings would continue to be held with farmer input and sharing. Farmers could learn the latest techniques concerning water contamination and soil erosion from professionals and their peers. County level newsletters or magazine articles could bring awareness of the most recent research findings and the information gleaned from local research projects completed by farmers and conservation education specialists. During stage two, farmers would change conservation behavior on a trial basis. Farmers would gain knowledge through the observation of techniques on small plots on their own farms. Through trial, observation and evaluation, farmers would be able to assess the value of new conservation sytems on their own. Equipment, products, and information would be used as incentives to encourage participation. Participants would be able to experiment to determine the usefulness and economic benefit to them in their own setting. Economic advantages of reduced tillage systems would need to be stressed through education programming.

Steigler (1987) indicated economics was a major obstacle to the adoption of conservation tillage practices. In the integration stage, agriculturalists would phase the conservation system into the total farming operation. The system would be modified to fit individual needs and management capabilities. It would be important to document the results through a detailed record keeping process in order to determine program benefits. Further, it would be critically important to have education professionals follow-up all three stages of development and facilitate the collection of the data. Collected data would be analyzed and evaluated to indicate the economic advantages of the system. In addition, feedback would be important to diffuse the system to the total population. Farmers who participated in stage two would be encouraged to share the results with other farmers. Farmers who were identified as early adopters would be encouraged to talk with and discuss plot research findings with other farmers. Participating farmers would be invited to share their findings with other farmers during local field demonstration days. Further refinement of the system could occur through feedback of the participants and interested farmers.

Ideally, this model would be adapted and used at the secondary and post-secondary education levels with students studying agriculture and environmental sciences. Students could play a major leadership role in the adoption of conservation plans by determining needs of farms within their school districts. Approved practices could be applied to model or school farms and the results could be analyzed and interpreted in laboratories with the aid of agriculture teachers, government personnel, and community industry support. These same students could become valualbe assets as concerned citizens of the future, as they continue to cope with environmental issues.

An effective approach could be to involve farmers and farm groups in the process of field-based farm research efforts where the farmer is a valued member of the team. Obviously, the top down approach has not worked. Farm-based research could lead to the discovery of learning as a process. The importance of determining alternative solutions through a decision-making process should be stressed. Community welfare is also important. Farmers must understand the importance of water quality and soil conservation and their impact on the community environment in which they live. Ultimately, the changes that society would like to see come about must come through a corroborative educational effort of all involved groups.

CONCLUSIONS

The researchers acknowledge the limitations imposed on drawing general conclusions and making broad recommendations based on a single study. However, the researchers also recognize the need to initiate and confirm general conclusions and recommendations which can serve as a framework for planning educational programs in soil and water conservation.

The following conclusions were drawn from the findings of the study:

1. There is a lack of agreement among farmers as to the precise definition of what constitutes the correct strategies for conservation tillage.

2. Respondents indicated that education was the key to developing a better understanding of the issues and the adoption of a system of improved practices.

3. Groundwater and water quality issues seemed to be of greater concern to the respondents as a whole in this study than soil conservation issues.

4. Respondents in this study indicated that soil and water conservation are societal problems (urban, rural, industrial), not just a rural agricultural problem.

RECOMMENDATIONS

Based on the findings and conclusions of the study, the literature reviewed, and the researchers' experience, the following recommendations were formulated:

1. Specific targeted and unbiased education regarding conservation and environmental issues should be incorporated into educational programs for farm, urban, and industry individuals and groups.

2. Field demonstration research plots using local commissioners and non-commissioners (farmers) teaming up with university researchers, industry representatives, and county education resources should be used to facilitate the conservation education process.

3. Farmers should be encouraged to perform annual soil tests on their fields and learn how to interpret the results in order to develop a systematic plan for utilization of nutrients.

4. As a concept, conservation tillage should be more precisely defined and published in order that farmers and education specialists can agree on functional terminology.

5. The soil and water conservation model developed as a result of this study should be used as a guide for structuring education for farmers, commissioners, and students studying conservation issues.

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Table 1. Rank order of means and standard deviations regarding the level of agreement of respondents concerning perceptions about environmental issues[a]

Rank	Item	n	Mean	S.D.
1	Farmers have benefited from CRP even though they may have caused the problem	432	4.37	0.82
2	Urban threat of chemicals is as great a threat as farm chemical use	432	4.32	0.92
3	More precise, unbiased education is needed for agri-chemical management	432	4.20	0.89
4	Improved communication and information about chemical management is needed	432	4.16	0.91
5	Ground water contamination is a serious problem	432	4.07	1.04
6	I know what I have to do in order to meet provisions of the Food Security Act	432	3.98	1.09
7	Side dressing is an acceptable alternative practice to broadcasting	432	3.96	1.10
8	Farmers should attend fertilizer management clinics to gain knowledge	432	3.94	0.97
9	Chemicals pose a serious threat to groundwater	432	3.91	1.11
10	Information about pesticide application would reduce risk of contamination	432	3.87	0.94
11	Crop residue is adequate to control erosion on my farm at planting time	432	3.85	0.98
12	Industry should provide training for pesticide use	432	3.79	1.08
13	Farmers apply too much nitrogen per acre	432	3.57	1.31
14	Nitrogen fertilizer rates should be reduced to avoid contamination	432	3.54	1.16
15	In conservation tillage, farmers use more pesticides	432	3.52	1.23
16	Chemical application rates are higher when using reduced tillage systems	432	3.52	1.30
17	Banding herbicides is an effective measure to reduce threat of contamination	432	3.51	1.23
18	Farmers use more herbicides than necessary	432	3.31	1.23
19	No-till plating is a conservation practice that will work on my farm	432	3.26	1.31
20	A cover crop planted in HEL would be an acceptable alternative practice to no-till	432	3.24	1.17
21	Federal government should give higher payments to enroll more acres in CRP	432	3.00	1.29

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[a] Scale: 1 = Strongly Disagree; 2 = Somewhat Disagree; 3 = Neutral: 4 = Somewhat Agree; 5 = Strongly Agree.

Table 1. (Continued)

Rank	Item	n	Mean	S.D.
22	Agricultural pesticides, if used correctly, pose no threat to water quality	432	2.97	1.19
23	Commercial soil test labs recommend correct amounts of fertilizer	432	2.91	1.10
24	Groundwater research should be funded through a surtax on pesticides	432	2.88	1.30
25	Fertilizer equipment is adequately designed for conservation tillage	432	2.82	1.09
26	Atrazine should be banned until the potential effects are known	432	2.80	1.32
27	Nitrogen rates could be reduced on my own farm without hurting my net profit	432	2.72	1.17
28	Conservation tillage results in reduced crop yields	432	2.62	1.26
29	Relaxing soil loss requirements by the USDA is an appropriate plan	432	2.46	1.34
30	Groundwater warning statements found on pesticide labels are effective	432	2.46	1.16
31	Fertilizer rates need to be higher when using reduced tillage systems	432	2.31	1.09
32	Increased use of reduced tillage systems is a threat to water quality	432	2.28	1.21

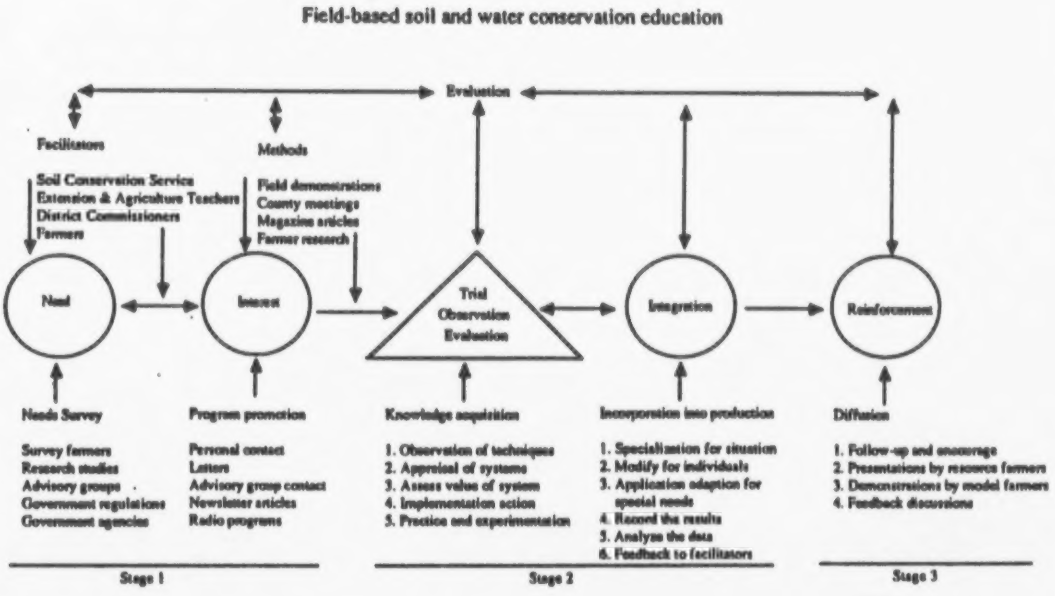
Field-based soil and water conservation education
Evaluation
Facilitators
Soil Conservation Service
Extension & Agriculture Teachers
District Commissioners
Farmers
Methods
Field demonstrations
County meetings
Magazine articles
Farmer research
Need
Interest
Trial
Observation
Evaluation
Integration
Reinforcement
Needs Survey
Survey farmers
Research studies
Advisory groups
Government regulations
Government agencies
Program promotion
Personal contact
Letters
Advisory group contact
Newsletter articles
Radio programs
Knowledge acquisition
1. Observation of techniques
2. Appraisal of systems
3. Assess value of system
4. Implementation action
5. Practice and experimentation
Incorporation into production
1. Specialization for situation
2. Modify for individuals
3. Application adaption for special needs
4. Record the results
5. Analyze the data
6. Feedback to facilitators
Diffusion
1. Follow-up and encourage
2. Presentations by resource farmers
3. Demonstrations by model farmers
4. Feedback discussions
Stage 1
Stage 2
Stage 3

Figure 1. Soil and water conservation education model

AGRICULTURAL EMPLOYMENT IN THE ILLINOIS FOOD AND FIBER SYSTEM

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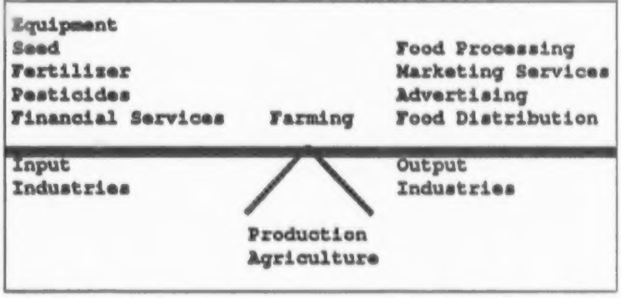
AGRICULTURE EMPLOYMENT IN THE ILLINOIS FOOD AND FIBER SYSTEM

INTRODUCTION

Illinois Department of Employment Security (IDES) is considered to be the official agency for collecting and reporting state employment trend data. IDES uses a nationally recognized system of defining occupations, the Standard Industrial Classification (SIC) code. This employment data is made available to vocational program planners through the establishment of a coordinating committee (National Occupational Information Coordinating Committee/State Occupational Information Coordinating Committee, NOICC/SOICC), as specified in the Carl D. Perkins Vocational Education Act of 1984. Unfortunately, the SIC definition includes only a fraction of what agriculturists refer to as the food and fiber system. This mismatch in the definition of agriculture is perceived to be a problem of national importance. As recently noted in the American Vocational Association newspaper Update (1989, December), the Carl D. Perkins reauthorization legislation recently approved by the House of Representatives (H.R.7) and the Senate bill recently passed by the Senate Committee on Labor and Human Resources (S. 1109), both retain the NOICC/SOICC provision and adds a requirement that information be available on employment demand for agribusiness. Currently the NOICC/SOICC data does not separate and report agribusiness employment, which would more accurately represent what is referred to by the United States Department of Agriculture (U.S.D.A.) as the food and fiber system. The food and fiber system can be defined around input and output industries in relation to production agriculture.

As noted in figure 1, agricultural production is the centerpiece around which other agriculturally related industries form their services and products. Therefore, the total size of the food and fiber system is determined by the types of industries which are considered to be a necessary contributor as either an input or output industry.

Figure 1 - Food and Fiber System



The problem of using existing IDES data reports for program planning purposes has become more of an issue within the last decade as vocational programs have expanded their mission and attracted a more diverse student population. A recent study sponsored by the Illinois State Board of Education/Department of Adult, Vocational and Technical Education (ISBE/DAVTE, 1989) reported that non-farm students are more typical of agriculture education students today than ever before in the history of agricultural education in Illinois. Since 1987, the percentage of non-farm students has increased from 56% of total agriculture education enrollment to 69% of the total enrollment in 1989. According to the ISBE (1988), female enrollment in secondary agriculture education programs increased 18% between 1972 and 1986. The majority of students studying agriculture do not plan to pursue a career in production agriculture but instead work in an agribusiness. To address the needs of these students, vocational program planners are encouraged to collect and review labor market information (LMI) on industries and occupations which relate to the program areas.

The agriculture data traditionally collected and reported by IDES does not adequately isolate the off-farm portion of the food and fiber industry. Several factors contribute to the inadequacy of the data: (1) many agricultural jobs are not reported through ''standard'' channels, (2) in many compilations of LMI, ''agriculture'' is narrowly defined as farming, fishing and forestry (3) self-employed, small businesses, and entrepreneurial situations are often deleted from reports due to the confidential nature of the data, and (4) many agricultural jobs outside of production, forestry, and fishing are compiled as nonagricultural (Law, Smith, and Herbst, 1985).

Over the last 10 to 15 years numerous attempts have been made at the state and national levels to identify and report the number of persons employed in occupations related to agriculture (USDA, 1975; Copa, 1980; Sands, Swanson, and Herbst, 1980; Pepple, Law, and Smith, 1986; ISBE/DAVTE, 1986; Zurbrick, 1986; Coulter, Stanton, and Goecker, 1986; Schluter, Lee, and Edmondson, 1986; and Edmondson and Schluter, 1986). -These last two studies represent the first systematic quantification of employment originating in the U.S. Food and Fiber System. In general, however, these efforts have met with varying degrees of success and in some cases have caused a great deal of misunderstanding in defining agricultural employment. Copa (1980) stated that agricultural employment may be as large as 25-50% of the employment in the states of the Central Region, but if it is only farming, it is perhaps less than 5%.

Copa (1980) used the Department of Labor, Agriculture, Commerce and Health, Education and Welfare methodologies to identify agricultural jobs, projections, and employment possibilities in Minnesota. Copa concluded that their findings underestimate the agricultural employment by as much as 10-20% since some combination of occupation and industry still remain undetermined as being either agricultural or not. Zurbrick (1986) stated that agricultural employment is one of the most misunderstood and poorly estimated of published figures. He continued to point out that the conflicts among reported figures for agricultural employment illustrate a major weakness in existing federal/state occupational employment statistics for educational planning purposes in agriculture. Zurbrick concluded that failure to provide accurate data on all employment requiring agricultural competencies greatly limits students' perceptions of the true occupational opportunities in agriculture.

Law, Smith, and Herbst (1985) attempted to assess the employment needs for Illinois agriculture by gathering information primarily from secondary sources. Material was gathered from U.S. censuses reports, IDES, SOICC, U.S.D.A., U.S.D.E., the Illinois Department of Agriculture, Illinois Cooperative Crop Reporting Service, and the Illinois Environmental Protection Agency. Other offices contacted were the Center for Government Studies at Northern Illinois University at Dekalb, the Illinois Department of Conservation, and agricultural specialists at the University of Illinois, Urbana-Champaign. Telephone interviews were also conducted with various agricultural organizations in the state. The researchers noted that difficulties can accompany a study of this kind. First, census information can get out of date. A second problem is that employment figures are not listed according the taxonomy areas of Agriculture Occupations. The researchers reported that employment specialists mentioned several times that the state organizations that dealt with employment of a general nature did not have ''a real good handle'' on the jobs in agriculture. The conclusions from their study note that the lack of detailed, comprehensive information on agriculture occupations precluded compiling statistically valid projections. Therefore, their findings are intended to infer and not validate the agriculture employment situation. Their research identified approximately 450,000 agricultural related jobs in Illinois. This would represent less than ten percent of the total Illinois civilian employment.

The study by Coulter, Stanton, and Goecker (1986) reported a summary of updated statistical information originally published by the USDA in 1980. This update provides a national assessment of employment opportunities for college graduates nation wide. However, this report does not address the many employment opportunities which are available to students who do not have a college degree. Also, their report of agricultural employment falls short of the USDA estimate of employment in the food and fiber system being about 20-25% of the total U.S. civilian employment.

Schluter, Lee, and Edmondson (1986) presented a procedure for estimating employment and income originating in the U.S. food and fiber system. They defined the food and fiber system (FFS) to include ''all businesses which contribute economic activity which results in the eventual delivery of food, clothing, and shoes, tobacco, and flowers to domestic consumers and which helps support agricultural exports...(the FFS) also includes the effects of imported food and fiber products and farm capital expenditures.'' They used the 1977 U.S. input-output (I/O) transaction table as the base for their estimation of income and employment due to final demands for food and fiber products. Their results reported that the FFS, at the national level, employed 21.4 million full-time equivalent workers in 1985. It accounted for 17.5% of total GNP and employed 18.5% of the available civilian work force.

In another study, at the state level, Edmondson and Schluter (1986) estimated a total of 1,044,200 workers as being employed in the food and fiber system in Illinois, with the state ranking fifth in the U.S. However, neither one of the two previous studies indicated the type of occupations and particular industries where these workers were employed. This led to a need for more complete and accurate data which will identify the occupations (using OES and DOT descriptions) where the Illinois labor force is employed as related to agriculture, and to identify the specific types of industries (by SIC Code) making up the Illinois food and fiber system.

OBJECTIVES

The objectives of this paper are to:

A. Identify the Standard Industrial Classification (SIC) manual Divisions where agricultural related merchandise/service functions exist in the Illinois food and fiber system by using input/output analysis procedures.

B. Identify the employment base in the agricultural related industries, using IDES data, which makes up the Illinois food and fiber system.

METHODOLOGY

Identifying the Food and Fiber System

To ascertain the importance of the agricultural related employment in Illinois, the authors followed the estimating procedure of employment originating in the U.S. food and fiber system presented in a USDA study by Lee, Schluter, Edmondson, and Wills (1987).

In this procedure, I/O analysis is used to trace the direct and indirect linkages among economic activities. The U.S. I/O transaction tables (U.S. Department of Commerce) disaggregate all economic activities into an industry classification of 79 economic sectors, including the range of activities from farming, food processing, transportation, to wholesaling and retailing. Individual jobs within these categories include a range of activities, specified in the Dictionary of Occupational Classifications (DOT) manual. All directly or indirectly support the food and fiber system, the output of which in turn satisfies the final demand in the economy.

The authors updating procedure used the sectoral state share distribution of employment derived from the USDA national level estimates of employment in the food and fiber system (Lee, Schluter, Edmondson, and Wills, 1987). This sectoral state share distribution would serve as the basis for the base year estimates of employment supporting final demands for food and fiber products in each sector of I/O industries. In the 1987 USDA study, the state employment share distribution for the farm sector were derived from total manhours required for production of crops and livestock and state cash receipt data. The nonfarm and government shares were derived from output per employee hour in selected industries.

Research Procedures

In 1987 ISBE/DAVTE funded a two year project to identify the agriculture employment in the Illinois food and fiber system. This project had two overall objectives: (1) to survey and report employment in the SIC Major Industry Group - Agricultural Services (Pepple, Valdes, and Helgesen, 1989), and (2) to identify employment in agricultural related industries in Illinois using data currently collected and reported by IDES and IOICC (Pepple, Valdes, Law, and Helgesen, 1989). This paper is concerned with reporting a part of the findings from the second overall objective.

IDES made available a copy of their 1988 employment data file and the researchers downloaded the employment file into the University of Illinois VMD computer system. A program file was developed using SAS (Statistical Analysis System) software to read and analyze the data file.

A review of the SIC manual by a panel of experts revealed a total of 40 SIC industry groups, in Illinois, as having a percentage of their establishments associated with the food and fiber system (this number does not include Agricultural Production and Agricultural Services Industries, which by definition are already within the FFS).

This panel of experts selected SIC industries where agricultural related merchandise/services were identified and matched with occupations (by DOT titles) which might require agribusiness competencies. All identified occupations were aggregated into eight main Occupational Employment Statistics (OES) classification categories --managers and owners, professional and technical occupations, machine operative occupations, mechanics and repairers, production and maintenance occupations, construction and repair occupations, sales and services occupations, and a last category of clerical occupations.

Therefore, to measure the impact of food and fiber employment in Illinois, the researchers made use of the state and sectoral contribution to the total employment using the 79-sector U.S. input/output industry categories and their composition in terms of the SIC codes. The 79-sector US input-output table were aggregated into ten main categories related to the Illinois food and fiber system employment covering all SIC industries in the economy. These ten categories were to include: three categories of farm production of goods and services (agricultural production, agricultural services, and forestry); two categories of farm product manufacturing (food processing and textiles); one category of direct distribution of processed products to consumers (eating places); trade (wholesale and retail); transportation; one category of supporting manufactured inputs (such as farm machinery and construction); and one category which includes service industries and all others not previously included.

The statistical procedure for calculating estimated employment for a specific OES occupation at the 3-digit SIC level in one estimating cell sector for an area i, is as follows:

Food and Fiber Sectors	eki	pki	wki
1			
Through			
10	M		

where:

E = occupational estimate
ek = employment for a specific occupation reported by industry k
pk = summed total employment reported by industry k
wk = weight for industry as reported by the state share distribution coefficient (a bridge table by USDA (1987) study).
M = benchmark employment for the cell as of the end of 1988, reported at the 3-digit SIC level
n = number of industries within each sector of the food and fiber system in Illinois.
i = area indicator derived from the Illinois State Board of Education Regions.

Occupational Estimate:

$$E = \left[\left(\frac{W_{ki} M}{\sum_{k=1}^{n} P} \right) \sum_{k=1}^{n} e_{ki} \right]$$

RESULTS

Using IDES data which reported a civilian work force of 5,648,000 in Illinois (representing all workers, including unpaid family workers and the self-employed which account for a total of 350,000 workers), this study identified 1,153,798 workers in the Illinois food and fiber system. This includes workers involved in producing, assembling, marketing, and processing raw farm products and distributing those products to domestic and foreign consumers. Therefore, agricultural-based employment was determined to account for 20.4 percent of Illinois civilian employment. These results are very similar to the Edmondson and Schluter (1986) survey.

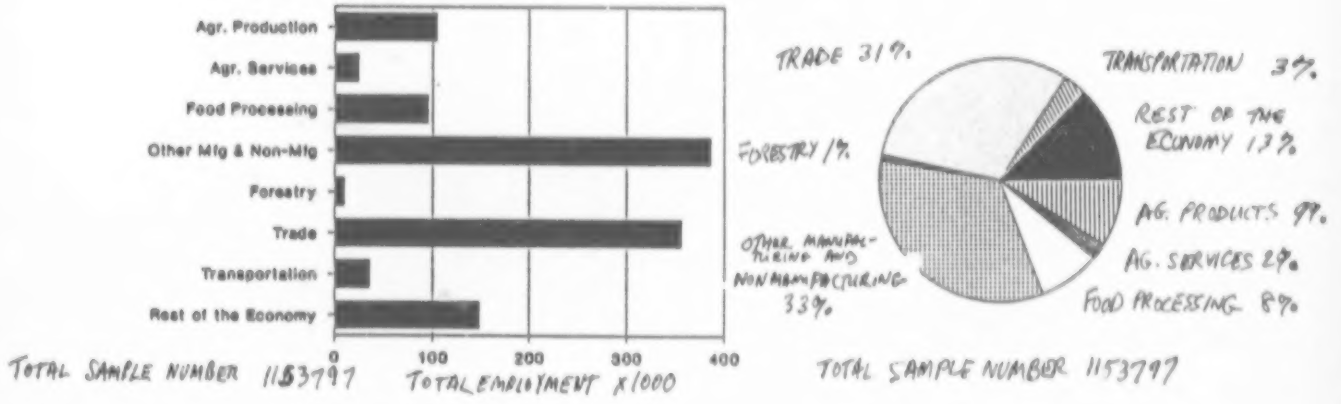
Table 1 - Agribusiness Employment in Selected Sectors of the Food and Fiber System in Illinois

Sectors		Total Employment
1. Agricultural Production		104,273
2. Agricultural Services, Forestry and Fisheries		27,694
3. Eating Places		165,467
4. Food Processing		51,957
5. Other Manufacturing and Non - Manufacturing		193,297
6. Trade		211,696
7. Transportation		69,146
8. Rest of the Economy		47,166
9. Other Non - Surveyed		283,101
	Total	1,153,797

Note. Totals may not add due to rounding

As shown in Table 1 above, 1988 employment in the Illinois food and fiber system was dispersed throughout the SIC industry groups. Agricultural Production had 104,273 employees (9%), Agricultural Services had 24,183 employees (2%), Food Processing had 95,578 employees (8%), Other Manufacturing and Non-manufacturing had 385,982 employees (33%), Trade had 356,561 employees (31%), Transportation had 35,726 (3%), Forestry had 3,569 employees (less than 1%), and the Rest of the Economy had 147,925 employees (13%). An investigation of Figures 2 and 3 suggest that employment in the more ''traditional'' agricultural sectors (agricultural production, agricultural services, food processing, and forestry) accounts for about 20 to 25 percent of the jobs in the food and fiber system. The vast majority (75 to 80%) of the jobs are to be found in other sectors, namely Other Manufacturing and Non-Manufacturing, Trade, and the Rest of the Economy.

Illinois Employment Within Eight Sectors of the Food and Fiber System



The major industry groups making up the Other Manufacturing and Non-Manufacturing sector were:

SIC 154 General Building Contractors
SIC 769 Miscellaneous Repair Shops & Related Services
SIC 352 Farm and Garden Machinery & Equipment
SIC 611 Federally Sponsored Credit Agencies
SIC 615 Business Credit Institutions
SIC 616 Mortgage Bankers & Brokers
SIC 622 Commodity Contracts-Brokers & Dealers
SIC 623 Security and Commodity Exchange
SIC 633 Fire, Marine and Casualty Insurance Carriers
SIC 651 Real Estate Operators and Lessors

The manufacturing part of this sector includes industries which are engaged in the construction (including new work, additions, alterations, remodeling and repair) of industrial buildings and warehouses. This includes the construction of grain elevators. They also construct other non-residential buildings such as farm buildings, grain bins, and silos. Another group of industries are engaged in specialized repair, including agricultural equipment repair, diesel engine repair, farm machinery repair, and tractor repair. A third group of manufacturing industries are engaged in manufacturing farm machinery and equipment. Included in this group are establishments primarily engaged in manufacturing commercial mowing and other turf and grounds care equipment.

The majority of this sector consists of corporations that lease to, insure, and lend to the industries that produce the ''food'' in the food and fiber system. Some of these are establishments of the federal government and federally sponsored credit agencies. Business credit establishments include private establishments engaged in extending agricultural credit, such as agricultural loan, farm mortgage and livestock loan companies. Commodity Contracts-Brokers and Dealers includes establishments primarily engaged in buying and selling of commodity contracts on either a spot or future basis for their own account or the account of others. Real Estate Operators and Lessors includes establishments which are involved in the leasing of agricultural properties and forest products.

The major industry groups making up the Wholesale and Retail Trade sector were:

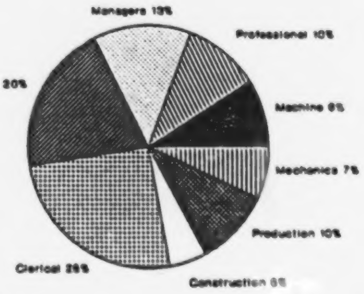
SIC 508 Machinery, Equipment and Supplies-Wholesale
SIC 514 Groceries and Related Products-Wholesale
SIC 515 Farm Product-Raw Materials-Wholesale
SIC 519 Miscellaneous Nondurable Goods-Wholesale
SIC 526 Retail Nurseries, Lawn and Garden Supply Stores
SIC 542 Retail Fish and Meat Markets
SIC 543 Retail Fruit and Vegetable Markets
SIC 596/9 Miscellaneous Retail

The Machinery, Equipment and Supplies-Wholesale category includes some establishments which are engaged in the distribution of farm and garden machinery for the preparation and maintenance of the soil, the planting and harvesting of the crops, and other processes pertaining to work on the farm, lawn, or garden. Other establishments distribute equipment such as dairy machinery, and cans for fruit and vegetables.

The Farm Product-Raw Materials-Wholesale category involves businesses engaged in the buying and/or marketing of grain and field beans, livestock, and other raw agricultural materials. Miscellaneous Nondurable Goods-Wholesale category includes establishments engaged in the wholesale distribution of animal feeds, fertilizer, agricultural chemicals, pesticides, seeds and other farm supplies.

Once the SIC industry groups were defined for the food and fiber system and placed into I/O categories the estimated employment could be determined. The IDES data file allowed the researchers to divide the total employment into the eight occupational categories as shown in Figure 4.

The total OES occupational employment distribution (excluding Agricultural Production and Agricultural Service Industries) was found to be 10% Professionals, 13% Managers, 20% Sales, 9% Machine, 7% Mechanics, 10% Production, 5% Construction, and 25% Clerical. This employment distribution was broken out by the I/O categories to better identify the areas of employment. Table 2 presents the estimated employment in these sectors except in Agricultural Production. The employment structure in this sector does not lend itself to this type of analysis



Note: Total does not include Agricultural Production and Agricultural Services Industries

Total Sample Number: 1026343

Table 2 - Estimated Total employment in the Food and Fiber System in Illinois

OES Occupational Classification	A	B	C	D	E	F	G	H
Managers and Owners	136,435	2,009	246	6,546	75,162	28,478	4,036	19,958
Professional & Technical	106,114	2,633	2,215	5,982	44,052	28,959	52	22,221
Machine Operative	97,382	1,987	308	21,973	12,393	38,476	20,108	2,137
Mechanics & Repairers	74,957	377		6,234	6,639	14,431	1,674	45,602
Production & Maintenance	118,328	12,648	431	35,215	20,560	29,899	6,173	13,402
Construction & Repairers	47,455	407		5	46,699			344
Clerical Occupations	258,756	2,772	246	13,341	125,634	83,452	3,047	30,244
Sales & Service	210,119	1,350	123	6,282	54,844	132,866	637	14,017
Total	1,049,526	24,183	3,569	95,578	385,983	356,561	35,727	147,925

A = Total Employment
B = Agricultural Services
C = Forestry
D = Food Processing

E = Other Manufacturing and Non-Manufacturing
F = Trade
G = Transportation
H = Rest of the Economy

Data were also generated using the eight Labor Market Regions identified by the Illinois Department of Employment Security. This substate data can be used to assist program planners in determining local and regional employment opportunities in agriculture. The level of occupational detail in the data files allowed the researchers to define to occupational titles found under each of the eight major categories. For example, Mechanics and Repairers Occupations are classified and reported as supervisors and manager/supervisors, small engine specialists, electricians, and welders and cutters.

IMPLICATIONS

Employment data having this degree of specificity and provided at a sub-state, regional level should be an excellent tool for program planning. Using this methodology to identify and report agricultural related employment address many, if not all, the problems agricultural program planners have experienced in trying to define and collect reliable employment data.

1. The data source is the most widely used and accurate information available at the state level. Independent efforts to survey agribusinesses statewide or even regionally are only marginally successful. The small, local fertilizer/chemical dealer might respond to an employment survey being conducted by the local agricultural education instructor, but the large national/international corporations will not respond as they consider this information confidential. Also it is almost impossible to survey the total universe. Therefore, sampling techniques must be used which can be inferred to the population being studied.

2. The data is current and can be accessed in future years to generate occupational projections. One piece of data which is most valuable to program planners is projection data which provides trends for various occupations within the state. Current LMI projects are being prepared for the year 2000. This study will allow for the development of occupational trend data for agriculture employment at the state and substate levels using the most recent data available from the Department of Employment Security..

3. Since the data is not collected by special interest groups in agriculture, it is free of collection bias. The employment data base is collected by the official employment state agency. If data is collected by agriculturists, groups outside agriculture can charge that the data is self-serving and not reliable and valid.

4. The procedures used for this study can be replicated in other states where data is collected through similar state/federal agencies. In states where SOICC is used to collect and report employment data this methodology can be replicated. It only requires access to the current employment data from the Department of Employment Security.

5. The confusion over the definition of agriculture and agricultural related employment should be lessened. The Standard Industrial Classification and the Standard Occupational Classification manuals are used as the basis for defining the universe for the study. The industries and occupations targeted for analysis can be adjusted to meet a states working definition for their Food and Fiber System.

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A REACTION TO

A NATIONAL SURVEY OF TWO-YEAR POSTSECONDARY INSTITUTIONS TO DETERMINE SELECTED AGRICULTURE PROGRAM CHARACTERISTICS

Jerome Migler
Graduate Research Assistant

Jim Warner
Graduate Research Assistant

Roland Peterson
Professor

by
James T. Horner
Professor, Agricultural Education
University of Nebraska-Lincoln

Certainly, with the proliferation of two-year postsecondary educational institutions during the past quarter century, and with the dearth of descriptive data on such programs, as was vividly portrayed, the authors have obviously embarked upon a useful research project related to Postsecondary agricultural education. The methods used were quite appropriate and most adequate for such a study. The problem, objectives and procedures were well stated and executed. The report was clearly written.

With current dramatic demographic, occupational, economic and academic changes occurring, I predict that the researchers will be receiving many requests for their full report - - an excellent resource service.

The authors have offered some excellent ideas for further research, as well as a basis for productive discussions toward coordination, restructuring and evaluating post secondary technical agricultural programs. I believe both short and long term impacts will result.

I commend the authors on a practical, down-to-earth, well written study.

A REACTION TO

FARMER PERCEPTIONS OF SOIL AND WATER CONSERVATION ISSUES: IMPLICATIONS TO AGRICULTURAL & EXTENSION EDUCATION

Robert A. Martin
Associate Professor
Iowa State University

Thomas H. Bruening
Assistant Professor
Pennsylvania State University

by

James T. Horner
Professor, Agricultural Education
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One needs only to look at the National (and State) Initiatives in the Cooperative Extension Service and to listen to what farm folks and urban dwellers alike are saying related to ground water contamination and excessive uses of chemicals, to realize that Martin and Bruening have embarked upon a hot topic.

The authors have done more than the title of this paper suggests. They have sketched for us a "Model" educational plan, naming all the players -- consultants, farmers, dealers, water and soil conservation agencies and agricultural educators -- and the various aspects of a Partnership Educational Plan.

An excellent theoretical framework was based on relevant research. Purposes and methods were clearly stated. Appropriate statistical treatment was used, and the report was well written.

If agricultural educators will accept the important and very practical challenge to provide improved,unified education toward use and management of agricultural chemicals, both long and short term economic and environmental impact of exceptional significance could be the result.

The conclusions reached by the researchers seem warranted and the recommendations, practical and wise -- even urgent.

I commend the authors on a useful and timely research project.p

A REACTION TO

AGRICULTURAL EMPLOYMENT IN THE ILLINOIS FOOD AND FIBER SYSTEM

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by

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First, let me commend the authors for pursuing an important area of research which we in the field have puzzled over for decades. We have know that no federal/state classifications accurately portray the true agricultural employment situation and opportunities. We have never been able to cause change in those standard classifications, because we have not developed a better and salable system. It is difficult, and an almost hopeless task.

The researchers seem to have done an adequate job of reviewing most of the recent literature on the topic. I have no quarrel with the methods and statistics used, and I believe they have done a good job of processing the information available. However, the lack of information available still seems to me to be the problem. In his last few years as Program Officer in Agricultural Education, U. S. Office of Education (mid 70's), Neville Hunsicker headed a task force from the Departments of Agriculture,Education and Labor to tackle this problem at the national level. It was easy to get numbers in the production area and even in the agriculture input/output businesses, although there were lots of questions raised about some subgroups such as clerical and transportation in terms of "what agricultural competencies do they need?" The same is true here. The big problem, where the progress ground to a halt then, and I think the big problem still is the information not available. For example, the thousands of employees needing agricultural competencies in the non-agricultural segment. Included in that nebulous group would be private and public lawn and groundskeepers, sod and golf course employees among many others needing agricultural information and skills.

I'm aware that was not the intent of this research. Nonetheless, I believe if we are to present to the public, agricultural education program planners, and prospective students/employees accurate data on employment requiring agricultural competencies, we must fill that information gap.

A second question, in my view, is how to reconcile "agricultural based employment" with the need for agricultural education. For instance, will the public accept that employees working in eating places or transportation (T1), need agricultural skills and knowledge?

My final concern, the OES classification (T2) doesn't help me much in knowing just what, if any, agricultural knowledge and skills are required, say for a clerical or operative employee in transportation, even those working for firms in the food and fiber system.

Perhaps these comments reflect more on my frustrations than on the paper, (if so, please accept it as good therapy for me), or perhaps they will trigger some other researcher to take a whack at them. In any event, I sincerely hope the author will be able to report to us that their findings are being well received and that they are, indeed making an impact.

Again, I do commend our colleagues on a mammoth task in a very important area.

CURRICULUM AND CAREER MATURITY

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Teachers of agriculture have many opportunities for career guidance because they receive many requests for help from individuals in their communities. They also frequently have opportunities to contribute information valuable to other persons in the school who are providing guidance services because they visit the homes of students and because they work with their students intensively. Therefore, Phipps (1980) stated that agricultural educators' attention to career guidance need to far exceed the attention given by teachers of other content areas, and teachers of agriculture are the key individuals in a school's career guidance program. The current emphasis on vocational agricultural education and career development theory has brought to light a common focus on the emerging readiness and competence of individuals to not only enter but find satisfaction in the world of work. Recent developmental theory of vocational behavior depicts the selection of an occupation as a process which covers a considerable number of years, ranging from late childhood into the early stages of adulthood. Interest in determining the maturity of individuals in the areas that are critical to realistic career decision-making developed as a result of this realization. Reflecting this trend, career maturity has come to be used as a prerequisite to the ability to make a wise occupational choice. Moreover, as boys and girls progress through school and the educational level increases, the occupational implications of career decisions become clear. Therefore, educators ask questions such as: (1) when should instruction in the special disciplines and in the various vocational and professional fields begin?; (2) when should students be expected to choose between courses leading to different types of education and thus to different fields of work and occupations?; (3) is this student or group of students ready to make the choices called for by the school or college system and by the organization of the curriculum?; and (4) does taking a certain course, studying a certain unit, engaging in a certain extracurricular activity, being enrolled in a work experience program, or being counseled by a professional counselor in any way affect the readiness of students to make these decisions? (Super, 1974). In many states, the policy for enrolling in a vocational program is that students can be enrolled in vocational education at the start of their junior year in high school. Further, the philosophy and goals of vocational education are to have students prepared to enter the world of work upon completing high school. The problem is: "Are students ready to make these career decisions as this point of their life?" In a monograph based on a thorough survey of the literature, Mitchell (1979) emphasized the need to be able to answer such questions. Other researchers in career education, career counseling, and career development (Adams and Walker, 1977; Enderlein, 1976; Hoyt, 1980; McCaslin, Gross and Walker, 1977; Young and Schuh, 1975) also reported the widespread need.

REVIEW OF LITERATURE

There are many research studies about curriculum and career maturity. Among them, a few studies are about training curriculum and career maturity. For example, Pucel, Nelson, Heitzman, and Wheeler (1972) examined the relationship between the post-high school vocational training curricula and career maturity as measured by the Vocational Development Inventory (VDI) of Crites. They found that nine-month post-high school vocational training had a different effect upon the vocational maturity of persons taking part in different types of training: persons enrolled in the technical programs significantly increased in vocational maturity while persons enrolled in skilled and sales clerical programs did not.

Among the researches about curriculum and career maturity, the most popular and burning issue is the question--"Which school curriculum program produces students with higher levels of career maturity?". Many researchers have found that career education or guidance/counseling courses and career development courses have a positive effect in increasing students' level of career maturity (Anderson and Heimann, 1967; Babcock and Kaufman, 1976; Myers, Lindeman and Thompson, 1975; Omvig and Thomas, 1977; Omvig, Tulloch and Thomas, 1975; Schenk, Johnston and Jacobsen, 1979; Trebilco, 1984; Vriend, 1969; Ware, 1981; Ware and Beischel, 1979; Yongue, Todd and Burton, 1981). Based on the fact that vocational education is an important component of career education and provides experiences closely related to the world of work, students in a vocational curriculum could be assumed to be of higher career maturity than the students in other curricula. In accordance with this assumption, Thompson et al. (1981) found that the vocational/technical students scored higher on the attitudinal scales of the Career Development Inventory (CDI) than students in the other programs. They explained that the reason for the higher scores of the vocational/technical students on the attitudinal scales is perhaps that they would be entering the work force sooner and thus have planned and explored career goals more than other students.

To the contrary, Herr and Enderlein (1976) found that ninth and twelfth grade students in the academic curriculum were significantly higher in the attitudinal domain of career maturity measured by the Attitude Scale of the Career Maturity Inventory of Crites than ninth and twelfth grade students in vocational and general curriculum. In accordance with the findings of Herr and Enderlein's study (1976), Vriend (1969) found that students in college preparatory curriculum were significantly higher in career maturity as measured by the Vocational Maturity Ratings than the students in the other curriculum. Thompson, Lindeman and Super (1978) showed that there were small but consistent differences in favor of students in college preparatory or academic programs when compared to those pursuing general or vocational courses. This finding agrees with those of the Career Pattern Study (Super and Overstreet, 1960; Jordaan and Heyde, 1979). Thompson et al. (1981) also found that students in college preparatory and business programs tended to have higher scores than those in general and vocational programs on the cognitive scales of the CDI.

In summary, most researchers agree that vocational curriculum students are lower in career maturity than college preparatory curriculum students. Why are vocational curriculum students who are taking more career courses lower? Does this result mean that vocational curriculum is less effective in increasing the students' level of career maturity ? Herr and Enderlein suggested three possible explanations for the differences in career maturity among curricular groups, none of which was tested in their study (Herr and Enderlein, 1976, p. 236):

> "One is that intelligence and vocational maturity are highly correlated and that since curricula groupings are typically found to be separated by IQ scores, one should also expect such separation in vocational maturity.
> Second, it is conceivable that students come to the selection of ninth grade curricula with different travel and other experiences in the family which influence their vocational maturity. Since curricula groupings also typically reflect socioeconomic differences and such differences in affluence are predisposing conditions to the range of occupational models to which a student is likely to be exposed such a perspective seems reasonable.
> Third, it is possible that choices of some curricula reflect differences in the types of knowledge and orientation to choice assumed by vocational maturity. This would seem to be especially true when comparing academic versus general curricula. Theoretically, at least, the academic curriculum has a clear focus upon preparation for baccalaureate level education after high school. Thus, persons who choose it should have at least a global idea of their future goals. On the other hand, the general curriculum is seen as one for persons not having a clear commitment to either the focus upon post-secondary education as seen in the academic curriculum or a focus upon occupational tasks as seen in the business or vocational curricula. By definition persons choosing the ambiguity in goals which the general curriculum represents may be less vocationally mature than those choosing other more clearly focused curriculum."

Besides the reasons explained by Herr and Enderlein (1976), there are two more possible explanations for the differences in career maturity among curricular groups. One possible explanation is the differences in educational achievement between vocational and college preparatory curricula. Fetters (1975) found that vocational students are lower in educational achievement than students in college preparatory curriculum.

Another possible explanation for the curricula differences may be due to educational and vocational aspiration. Super and Overstreet (1960) found that there was a significant relationship between school curriculum and boy's vocational aspiration level. The significant relationship to school curriculum was understandable, because the higher the aspiration level, the more education will presumably be required to attain the goal. Esslinger (1976) stated that plans for continued education beyond high school and occupational choices related to the curriculum in high school. Powers (1974) found that ninth-grade students enrolled in vocational courses had slightly lower levels of occupational aspirations. Blackburn, Molnar, and Tulloch (1975) also found that academic students had proportionately higher educational and occupational aspirations than business or technical students. These findings were supported by Crawford (1975) when he found that students in academic program had higher educational and occupational aspirations than those in vocational program.

In summary, the reason why vocational students are lower in career maturity than students in non-vocational curricula may be due to variables such as mental ability, scholastic achievement, socioeconomic status, and educational and vocational aspiration.

PURPOSE

The purpose of this study was to measure the career maturity of senior high school students, and to determine the relationship between curriculum and the career maturity. This study was specifically conducted to determine the relationship of curriculum to career maturity of senior high school students, and to determine the intervening variables moderating the main variable (curriculum).

NULL HYPOTHESES

The following null hypotheses were established to examine the research purpose.

1. There will be no relationship between curriculum and career maturity.

2. If mental ability , scholastic achievement, social economic status, educational aspiration, and vocational aspiration are statistically controlled; there will be no relationship between curriculum and career maturity.

METHODOLOGY

The relational research method was used as the design for the study to test the hypotheses. Relational studies begin with specific hypotheses. The end sought by relational studies is to investigate relationships between variables in order to explain and predict (Miller, 1986, p.13).

Population and Sample

The target population used in this study was all senior high schools of eight counties within 50 miles from Columbus, Ohio, during 1988-89 school year. A total of 80 senior high schools in the eight counties was classified into urban and rural schools. A cluster sampling technique was used, where schools were the sampling units, and 1 urban school and 1 rural school were selected as a accessible population. And then, a stratified random sampling technique was used to select the same number of 10th and 12th vocational-male, vocational-female, college preparatory-male, college preparatory-female students from each of the rural and urban schools. The total number of students in the population was counted using the Ohio Educational Directory 1988-89. The total number in the population (target population) was 32,069 students. The accessible population was 983 students. Using the formula to determine sample size in order to be representative of the given population with 95% confidence (Krejcie & Morgan, 1970), it was determined that at least 278 students would be needed for the sample. Considering the needed number, the sample of this study--320 students:

Table 1
Nature in Sample

		Vocational		College Preparatory		Total
		Male	Female	Male	Female	
Urban School	10th	20	20	20	20	80
	12th	20	20	20	20	80
Rural School	10th	20	20	20	20	80
	12th	20	20	20	20	80
Total		80	80	80	80	320

Data Analysis

Two way analyses of variance and multiple regression analyses were used to develop a further understanding of the relationship of curriculum to career maturity. An alpha level of .05 was established prior to data treatment. To test hypothesis 2, the hierarchical analysis strategy was used because the independent variables could be ordered with regard to logical priority. This strategies allows the calculation of R^2_{change}. R^2_{change} is the increment in proportion of variance of the dependent variable accounted for by a given independent variable after controlling the other independent variables. That is, R^2_{change} indicates the proportion of variance of the dependent variable accounted for by a given independent variable after another variable(s) have already been taken into account. The square root of the R^2_{change} is a semipartial correlation. The semipartial correlation is the correlation between an independent variable and the dependent variable when the linear effects of the other independent variable(s) have been removed (partialled out) from the independent variable being considered. That is, in a semipartial correlation the effect of the other independent variable(s) have been partialled out from the independent variable being considered, but not from the dependent variable. Testing the significance of a semipartial correlation is the same as testing the significance of the partial regression coefficient (bk) associated with it.

Instrument

The subjects were administered the Career Development Inventory developed by Thompson et al. (1981). The subjects were also administered a questionnaire as a means of obtaining demographic data such as curriculum, gender, grade, location of residence, educational aspiration, vocational aspiration, and parents' or guardians' occupation. Level of mental ability and grade point average scores were provided by school counselors.

RESULTS

In order to test hypothesis 1, two way analysis of variance was used. As shown in Table 2, the mean scores for affective career maturity of college preparatory and vocational students were 107.9 and 72.8 in tenth graders, and 128.9 and 108.4 in twelfth graders respectively. Both in tenth and twelfth grades, college preparatory students were significantly higher than vocational students. The interaction between curriculum and grade in affective career maturity were found significant. That is, the difference in affective career maturity between college preparatory students and vocational students was significantly less in twelfth graders than in tenth graders.

As shown in Table 3, the mean scores for cognitive career maturity of college preparatory and vocational students were 102.0 and 87.2 in tenth graders, and 108.6 and 90.7 in twelfth graders, respectively. Both in tenth and twelfth grades, college preparatory students were significantly higher than vocational students. The interaction between curriculum and grade in cognitive career maturity was found not significant. That is, the difference in cognitive career maturity between college preparatory students and vocational students was not significantly different between twelfth graders than in tenth graders.

Table 2
Two Way (Curriculum X Grade) Analysis of Variance
of the Affective Career Maturity

	Grade		
Curriculum	10th	12th	Curriculum Means
College Preparatory	107.9	128.9	118.4
Vocational	72.8	108.4	90.6
Grade Means	90.3	118.7	104.5
			(Grand Means)

Source	df	SS	MS	F.
Curriculum	1	62300.7	62300.7	301.67*
Grade	1	64099.5	64099.5	310.38*
Curriculum X Grade	1	4212.3	4212.3	20.40*
Within (residual)	316	65259.5	206.5	
Total	319	195872.0		

*p<.05

Table 3
Two Way (Curriculum X Grade) Analysis of Variance
of the Cognitive Career Maturity

	Grade		
Curriculum	10th	12th	Curriculum Means
College Preparatory	102.0	108.6	105.3
Vocational	87.2	90.7	89.0
Grade Means	94.6	99.7	97.1
			(Grand Means)

Source	df	SS	MS	F.
Curriculum	1	21385.8	21385.8	94.96*
Grade	1	2030.1	2030.1	9.01*
Curriculum X Grade	1	180.0	180.0	.80
Within (residual)	316	71162.6	71162.6	
Total	319	94758.5		

*p<.05

In order to test hypothesis 2, the hierarchical analysis using sets of independent variables (Cohen and Cohen, 1983, pp 133-177) was used. As shown in Tables 4-7, the set of rival independent variables (mental ability, scholastic achievement, social economic status, educational aspiration, and vocational aspiration) were entered first, and then the main independent variable (curriculum) was entered.

In Tables 4-5, subjects were tenth graders. In Table 4, the dependent variable was affective career maturity, and the R^2_{change} was .322 when the main independent variable (curriculum) was added. Therefore, the semipartial correlation of curriculum to affective career maturity was .57 (square root of .322), which was statistically significant. In Table 5, the dependent variable was cognitive career maturity, and the R^2_{change} was .003 when the main independent variable (curriculum) was added. Therefore, the semipartial correlation of curriculum to affective career maturity was .05 (square root of .003), which was not statistically significant. Moreover, the regression coefficient of curriculum was a negative number.

In Tables 6-7, subjects were twelfth graders. In Table 6, the dependent variable was affective career maturity, and the R^2_{change} was .053 when the main independent variable (curriculum) was added. Therefore, the semipartial correlation of curriculum to affective career maturity was .23 (square root of .053), which was statistically significant. The partial regression coefficient of curriculum (13.757) in twelfth graders was much smaller than the coefficient (35.869) in tenth graders. In Table 7, the dependent variable was cognitive career maturity, and the R^2_{change} was .001 when the main independent variable (curriculum) was added. Therefore, the semipartial correlation of curriculum to affective career maturity was .03 (square root of .001), which was not statistically significant. The partial regression coefficient of curriculum (1.898) in twelfth graders was much greater than the coefficient (-2.816) in tenth graders.

In short, in both tenth and twelfth graders, if mental ability, scholastic achievement, social economic status, educational aspiration, and vocational aspiration were statistically controlled; there was no significant relationship between curriculum and cognitive career maturity.

Table 4
Regression of Affective Career Maturity on Rival Independent Variables (Mental Ability, Scholastic Achievement, Social Economic Status, Educational Aspiration and Vocational Aspiration) and Main Independent Variable (Curriculum) in 10th Graders (n=160) (Hierarchical Entry)

Variables	R^2	R^2_{change}	b	Beta	t
Set of Rival Independent Variables	.349	.349			
o Mental Ability			.028	.013	.22
o Scholastic Achievement			5.224	.172	2.95*
o Social Economic Status			-.089	-.069	-1.32
o Educational Aspiration			.532	.029	.47
o Vocational Aspiration			-.196	-.196	-3.28*
Main Independent Variable	.671	.322			
o Curriculum[a]			35.869	.805	12.25*
(Constant)			70.278		

*$p<.05$
Adjusted R^2=.685
For Model: F=52.14; $p<.0001$
a: 0=Vocational; 1=College Preparatory

Table 5
Regression of Cognitive Career Maturity on Rival Independent Variables (Mental Ability, Scholastic Achievement, Social Economic Status, Educational Aspiration and Vocational Aspiration) and Main Independent Variable (Curriculum) in 10th Graders (n=160) (Hierarchical Entry)

Variables	R^2	R^2_{change}	b	Beta	t
Set of Rival Independent Variables	.641	.641			
o Mental Ability			.424	.259	4.26*
o Scholastic Achievement			14.549	.631	10.37*
o Social Economic Status			.031	.032	.59
o Educational Aspiration			1.744	.124	1.95
o Vocational Aspiration			-.020	-.026	-.42
Main Independent Variable	.644	.003			
o Curriculum[a]			-2.816	-.083	-1.21
(Constant)			33.771		

*$p<.05$
Adjusted R^2=.630
For Model: F=46.13; $p<.0001$
a: 0=Vocational; 1=College Preparatory

Table 6
Regression of Affective Career Maturity on Rival Independent Variables (Mental Ability, Scholastic Achievement, Social Economic Status, Educational Aspiration and Vocational Aspiration) and Main Independent Variable (Curriculum) in 12th Graders (n=160) (Hierarchical Entry)

Variables	R^2	R^2_{change}	b	Beta	t
Set of Rival Independent Variables	.412	.412			
o Mental Ability			-.051	-.027	-.35
o Scholastic Achievement			11.095	.460	6.01*
o Social Economic Status			-.099	-.108	-1.64
o Educational Aspiration			1.049	.069	.87
o Vocational Aspiration			-.082	-.099	-1.09
Main Independent Variable	.465	.053			
o Curriculum[a]			13.757	.381	3.88*
(Constant)			90.854		

*$p<.05$
Adjusted R^2=.444
For Model: F=22.16; $p<.0001$
a: 0=Vocational; 1=College Preparatory

Table 7

Regression of Cognitive Career Maturity on Rival Independent Variables (Mental Ability, Scholastic Achievement, Social Economic Status, Educational Aspiration and Vocational Aspiration) and Main Independent Variable (Curriculum) in 12th Graders (n=160) (Hierarchical Entry)

Variables	R^2	R^2_{change}	b	Beta	t
Set of Rival Independent Variables	.528	.528			
o Mental Ability			.463	.260	3.60*
o Scholastic Achievement			11.241	.493	6.87*
o Social Economic Status			.075	.087	1.41
o Educational Aspiration			-.342	-.024	-.32
o Vocational Aspiration			.006	.008	.09
Main Independent Variable	.529	.001			
o Curriculum[a]			1.898	.056	.60
(Constant)			45.002		

*$p<.05$
Adjusted $R^2=.511$
For Model: $F=28.65$; $p<.0001$
a: 0=Vocational; 1=College Preparatory

SUMMARY AND DISCUSSION

Both in the tenth and the twelfth grade, college preparatory students were significantly higher in affective and cognitive career maturity than vocational students. The difference in affective career maturity between college preparatory and vocational students was significantly less in twelfth graders than in the tenth graders. However, the difference in cognitive career maturity between college preparatory and vocational students was not significantly less in twelfth graders than in the tenth graders. The reason for the significant interaction in affective career maturity and non-significant interaction in cognitive career maturity could be explained in two ways. First, the difference may be due to the different characteristics of the two samples. This study was not a longitudinal but cross-sectional study. That is, the tenth grade students and twelfth grade students were different samples. Second, the difference may be due to the curriculum effect. The cognitive domain of learning was emphasized much more in the college preparatory curriculum that in the vocational curriculum, and, on the contrary, the affective domain of career development is emphasized much more in the vocational curriculum than in the college preparatory curriculum.

The results of this study indicated that the main independent variables (curriculum) was significantly associated with career maturity, and all of the rival independent variables (mental ability, scholastic achievement, social economic status, educational aspiration, and vocational aspiration) were significantly associated with career maturity. Significant relationships existed between curriculum and rival independent variables (mental ability, scholastic achievement, social economic status, educational aspiration, and vocational aspiration). When the rival independent variables were controlled, no significant relationship existed between curriculum and cognitive career maturity.

The implications of this study can be summarized as follows:

1. This study found that college preparatory students were significantly higher in career maturity than vocational students. Therefore, counselors need to revise their present career development practices in terms of experiences of the particular subgroup with

whom they are dealing. Also, counselors should be aware that, when predicting career maturity, different predictors should be employed depending on the subgroup of the subjects.

2. This study found that curriculum difference in career maturity was a function of such intervening variables as level of mental ability, scholastic achievement, social economic status, vocational aspiration and educational aspiration. Therefore, differential counseling based solely on curriculum is not appropriate. That is, career guidance and counseling need to be tailored to the intervening variables (mental ability, scholastic achievement, social economic status, educational aspiration and vocational aspiration) rather than to the main independent variable (curriculum).

3. This study found that individuals who had higher levels of mental ability, scholastic achievement and social economic status, and who set higher educational and vocational aspirations exhibited greater career maturity. That is, this study, like many other studies, pointed to the fact that career maturity should be viewed as a function of total human development. An important implication of this finding is that any program designed to facilitate career development must be conceived as part of a total educational experience aimed at developing a positive self concept, higher level of mental ability, scholastic achievement, educational aspiration and vocational aspiration, an understanding of one's own strength and weakness, skills in decision making and problem solving and appropriate work values. Therefore, as Super (1976) and other proponents of the career education movement would say, educational administrators should recognize that career education activities must be integrated into the total school curriculum in order to be optimally effective in terms of achieving the desired outcomes.

4. This study found that significant difference in the rate of career development existed among the subgroups classified based on the curriculum. Also, the career maturity was different depending on each student's characteristics such as mental ability, scholastic achievement, social economic status, educational aspiration, and vocational aspiration. Not a few students are vocationally uncertain at the completion of tenth grade when they were forced to decide their curriculum. For example, in 1983, when asked how certain students were about their occupational preferences, 27 percent of the eleventh grade students answered, "I am not sure at all" (Herr and Crammer, 1988, p. 269). In short, at the completion of tenth grade when many students are too immature to decide career choices, students are forced to finalize their curricular choice. Therefore, educational administrators are recommended to provide support for facilitating students' career maturity so that as students approach the end of the tenth grade they should have reached a stage of career development where they can make curricular choice wisely. Clearly, it would be an advantage if the first year of high school could be an exploratory period, when students were able to sample and react to a variety of courses in the manner once envisaged for junior high schools. If this is not feasible, administrative procedures should be flexible enough to facilitate transfer from one curricular track to another with as little penalty as possible. That is, more avenues must be created for all students to move freely among the curricula with the criteria for such movement being individual need, readiness, interest, motivation, and the blend of academic and vocational experiences to meet these criteria.

5. Since career maturity was associated with biological, social, psychological, educational and vocational variables; teachers are recommended to provide an environment which encourages students to take advantage of the activities which are offered. That is, teachers should do their best to help students to broaden their horizons, to explore potentially challenging but unfamiliar fields, and to experience the satisfactions that come with achievement, recognition, and mastery. Especially, vocational teachers must not only teach skills for specific occupations or skills across families of jobs, but also

develop within the students the elements of career development that will free them to discern the alternative ways to use these skills and to attain the personal competence to capitalize on these skills.

6. Teachers are recommended to expand their current educational objectives to include career-related activities and subjects. As Hoyt (1972) pointed out, career education must not be simply considered an extra course in the curriculum but an instructional strategy that relates established subject matter to career concepts. Career concepts and activities should be applied to many--if not all--subjects, and should be consciously taught as skills to be developed and refined. This idea of integrating career-development concepts into existing curricula is referred to as "career-education infusion". Also teachers should propose the following questions for students: (1) why am I taking the subject?; (2) what can I do with taking the course?; and (3) how is the subject related to my future career?

7. As Miller (1985) stated, "guidance is an essential component of vocational education" (p.24). Also, teachers are not just instructors. Therefore, every teachers needed a minimum knowledge about guidance; especially, vocational teachers need to provide information about their field of work. Therefore, teacher educators need to develop and offer courses about career guidance suited for students in their programs.

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EDUCATIONAL TECHNOLOGY IN SECONDARY AGRICULTURE PROGRAMS

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Instructional technology has become increasingly available for use by secondary teachers. Technological developments have contributed significantly to the acquisition and use of microcomputers in many educational settings. VCRs, camcorders, satellite receivers, and computer modems have also become available for use in high schools.

Knirk (1988) reviewed recent developments in technology with implications for education. He concluded that the use of technology in educational settings is one of the most important considerations educators will face in the 1990s. Rosenfeld (1986) also suggested that adapting teaching procedures to utilize technology should be a concern of agricultural educators.

Previous studies have placed significant emphasis on the use of microcomputers in educational settings. McCarney (1987) advocated shifting education from a labor-intensive emphasis to a capital-intensive emphasis and indicated that this could best be accomplished through the classroom use of technology such as computers and video cassette recorders. Because of cost and availability, microcomputers will continue to play an increasingly important role in agricultural education (Camp, 1983).

Several reports have described the use of instructional technology in high school programs. The Office of Educational Research and Improvement (1986) in the U.S. Department of Education reported that 99% of all public high schools in the United States have purchased microcomputers. A study by the National FFA Agricultural Computing Service (1985) reported that 51% of the secondary agricultural education programs had microcomputers. Miller and Kotrlik (1986) reported that only 39 percent of agriculture teachers had microcomputers and the primary use was for instructional management. Zidon and Luft (1986) found that most North Dakota agriculture teachers had access to microcomputers, perceived them to be effective for instruction, but used them for other purposes.

Foster and Miller (1985), Henderson (1985), and Malpiedi, Papritan, and Lichtensteiger (1985) completed studies which surveyed agricultural educators concerning the use of microcomputers. These studies indicated that further research was necessary regarding the use of microcomputers in programs of agriculture.

Because of differing reports of availability and use of microcomputers and other technology, this study was designed to collect additional information. Although subject to revision, current plans provide an indication of how teachers anticipate using new technology. Assessing the intentions of teachers was judged to be useful information for policy makers attempting to facilitate the infusion of educational technology in classrooms of tomorrow. This study was designed to document the status and to project the use of instructional technology in high school agricultural education programs.

Objectives

The purpose of this study was to assess the extent to which instructional technology has been and will be utilized in secondary programs of agricultural education in the United States. More specifically, this project was designed to fulfill the following objectives:

1. To identify the types and quantity of instructional technology available in high school agricultural education programs.

2. To ascertain if future plans differ from current use of instructional technology in high school agricultural education programs.

3. To identify barriers which inhibit greater use of instructional technology in high school agriculture programs.

Procedures

Funding from the National FFA Organization was provided to conduct a national study of the use of instructional technology in agricultural education programs. The population for the study was all secondary agriculture programs in the United States. Stratified, proportional, random sampling procedures were employed to identify agriculture programs to participate in the study. The population was stratified to provide input from each of the 50 states. Teachers from 479 secondary agriculture programs were randomly selected. An instrument with cover letter was mailed to each selected instructor. Those who did not respond within two weeks were sent a reminder postcard to encourage their response. Five weeks after postcards were sent, a second letter and instrument was sent to instructors who had not responded. Finally, a follow-up phone call was made to a 10 percent random sample of non-respondents.

The instrument requested information in the following areas: (a) types and quantity of equipment; (b) level of current use; (c) level of use planned for the future; (d) future needs for equipment, software, materials, training, and on-line computer services; and (e) barriers to using existing technology. A pilot test was conducted using members of the population which were not selected as part of the sample. Instrument validity was assessed by a panel of experts in Agricultural Education and Instructional Technology. Instrument reliability was estimated by calculating a Cronbach's alpha reliability coefficient of .98 using the data related to the current and anticipated use of educational technology.

The data collected were analyzed using descriptive statistics. T-tests were performed using data from the respondents and non-respondents on selected dependent variables to ascertain if the respondents were representative of the population. ANOVA tests were used to identify differences in the current and anticipated level of use of instructional technology for administration and planning, group instruction, and individual instruction.

Findings

Usable data collection instruments were received from 254 secondary agriculture teachers for a response rate of 53%. As a result of comparing the data collected from 254 respondents and 19 non-respondents, no significant differences were found between the groups on the inventory of equipment. There was also no significant differences found on the current use of traditional equipment such as the overhead projector; but a significant difference was found in the current use of microcomputers and their related peripherals.

The first objective was to identify and document the types and quantity of instructional technology available in high school programs of agriculture. Table 1 presents the percent of agriculture departments and schools reporting selected items of instructional equipment as well as the mean number of machines in the inventory of those programs with equipment. Nearly 73% of the agriculture departments have microcomputers as contrasted to 85% of the schools and 66% have microcomputer printers contrasted to 82% of the schools. As a point of reference, 80% of the departments and schools reported the availability of overhead projectors. Over half of the programs also reported having a carousel slide projector (67%), an audio cassette player (56%), and a film strip projector (61%) in the departmental inventory.

High schools tended to have a much more complete inventory of instructional equipment. Approximately 80 percent of the high schools reported having microcomputers, printers, VCR players, VCR cameras, carousel slide projectors, overhead projectors, and 16 mm film projectors. Schools were less likely to have acquired newer technologies such as microcomputer modems (37%), large screen television (24%), overhead computer projection units (23%), interactive video (20.5%), and satellite receiver dishes (15%).

The second objective was to assess differences in the current and anticipated use of instructional technology in high school programs of agriculture. As noted in Table 2, teachers anticipated increased use of equipment for administration and planning purposes. They also anticipated increased use of the more recently developed technology, but no change in the use of traditional equipment for group instructional purposes. Because of the significant difference in respondents and non-respondent reporting of current use of microcomputers, generalizations related to this data should be limited to respondents in the study.

The instructional equipment agriculture teachers anticipated using most included the VCR player/recorder and camera, the microcomputer and related peripherals, the carousel slide projector, and the overhead projector. The respondents also anticipated using the newer technology to a greater extent for individual instructional purposes. They anticipated using the microcomputer and the VCR recorder most often for individual

Table 1

Inventory of instructional equipment in agriculture departments and schools. (N = 254)

Equipment	Agriculture Departments			Schools		
	n	%	$\bar{X}$ inventory	n	%	$\bar{X}$ inventory
Microcomputer	185	72.8	2.4	216	85.0	32.0
Microcomputer modem	66	26.0	1.6	95	37.4	4.5
Microcomputer printer	168	66.1	1.7	209	82.3	15.4
Overhead computer projection unit	16	6.3	1.1	59	23.2	2.8
Amplified telephone	21	8.3	1.1	55	21.7	6.2
VCR player/recorder	90	35.4	1.4	208	81.9	5.6
VCR camera	50	19.7	1.5	208	81.9	2.5
Satellite receiver dish	7	2.8	1.1	39	15.4	1.1
Interactive video	10	3.9	1.1	52	20.5	2.2
Carousel slide projector	170	66.9	1.2	202	79.6	7.8
Overhead projector	204	80.3	1.4	202	79.6	16.8
Audio-cassette player	141	55.5	1.6	185	72.8	11.0
16mm film projector	120	47.2	1.2	204	80.3	7.7
Film strip projector	154	60.6	1.5	195	76.8	9.4
Opaque projector	45	17.7	1.3	189	74.4	2.8
Large screen TV	26	10.2	1.2	61	24.0	3.2

*Means are for the department/schools reporting equipment in inventory.

Table 2

Current and anticipated use of instructional technology in agriculture departments

Item	Group Instruction			Individual Instruction			Administration		
	$\bar{X}$ Current/Anticipated Use		F/p	$\bar{X}$ Current/Anticipated Use		F/p	$\bar{X}$ Current/Anticipated Use		F/p
Microcomputer	2.72	3.44	56.0/.01	2.91	3.62	50.9/.01	3.26	3.83	33.0/.01
Computer modem	1.58	2.36	65.8/.01	1.65	2.40	50.6/.01	1.64	2.54	72.0/.01
Computer printer	2.84	3.40	29.1/.01	2.82	3.41	34.6/.01	3.31	3.82	24.3/.01
Amplified phone	1.14	1.45	32.3/.01	xxxx	xxxx	xxxx/xxx	1.38	1.80	25.7/.01
VCR/recorder	3.16	3.67	38.7/.01	2.68	3.21	27.8/.01	3.27	3.68	24.5/.01
VCR camera	2.32	3.11	56.1/.01	2.14	2.78	32.9/.01	2.26	3.09	70.1/.01
Satellite dish	1.18	1.75	52.4/.01	1.22	1.64	27.3/.01	1.16	1.76	53.9/.01
Interactive video	1.18	1.57	29.9/.01	1.19	1.54	25.8/.01	1.17	1.60	32.8/.01
Slide projector	3.28	3.36	0.9/.34	2.71	2.87	3.2/.08	xxxx	xxxx	xxxx/xxx
Overhead projector	3.37	3.43	0.4/.52	2.39	2.46	0.4/.52	xxxx	xxxx	xxxx/xxx
Tape player	2.85	2.88	0.1/.73	2.52	2.62	1.1/.31	1.17	1.60	32.8/.01
Filmstrip projector	2.93	2.94	0.1/.88	2.54	2.56	0.1/.87	xxxx	xxxx	xxxx/xxx
16mm projector	2.80	2.83	0.1/.70	xxxx	xxxx	xxxx/xxx	xxxx	xxxx	xxxx/xxx

Responses were coded: 1 = never, 5 = always instruction. However, major changes were not anticipated in the use of other pieces of equipment for individual instructional purposes.

Objective three was to identify barriers which inhibit greater use of instructional technology in high school agriculture programs. When asked to identify barriers (Table 3), a lack of funding was most frequently cited. Most notably, 51% indicated a lack of funds would be a problem in utilizing microcomputers, 59% for modems, 67% for satellite receiver dishes, and 51% for interactive video. When the use of microcomputers specifically was examined, 29% indicated a lack of expertise in using the computer, 27% a lack of expertise in using the modem, and 30% a lack of materials and software to support the equipment.

Over one-fourth of the respondents (26%) indicated they had no interest in using the amplified telephone. Other instructional equipment on which 10 percent or more of the respondents reported "no interest" included the opaque projector (19%), interactive video (16%), satellite receiver dish (14%), overhead computer projection screen (11%), and microcomputer modem (10%). Three types of instructional equipment were perceived to have outdated support materials by over 10% of the respondents. Those items were the filmstrip projector (14%), carousel slide projector (12%), and the audio cassette player (11%).

Although other barriers were identified which limited the utilization of educational technology, the lack of funds to purchase the equipment, operate the equipment, or to obtain support materials appeared to overshadow all others. To a lesser degree, instructors who lack expertise or a shortage of available software were factors which limited the use of microcomputers and related peripherals.

Conclusions

1. Secondary agriculture departments do not maintain a state of the art inventory of instructional equipment.

2. Departmental control of instructional equipment does not appear to be a major factor governing its use for group instruction.

3. The population of agriculture teachers is less likely to use microcomputer-related materials than are the teachers responding to this survey.

4. Microcomputers continue to be primarily used for planning and administration rather than for instructional purposes in programs of agriculture.

5. Agriculture teachers desire to increase their use of microcomputers for instructional purposes.

6. Although aware of the various types of new technology available for instruction, most programs of agriculture will focus on the use of video and microcomputer equipment in the next few years.

Table 3

Percent of agriculture teacher responses to barriers in utilizing educational technology

Equipment	Lack of $ %	Lack of expertise %	Lack of materials %	No interest %	Materials outdated %
Microcomputer	51	29	30	4	3
Microcomputer modem	59	27	5	10	2
Microcomputer printer	42	15	10	4	4
Overhead computer projection screen	63	12	4	11	1
Amplified telephone	46	15	2	26	0
VCR player/recorder	37	1	8	0	2
VCR camera	50	5	2	4	1
Satellite receiver dish (downlink)	67	11	3	14	1
Interactive video	51	17	2	16	1
Carousel slide projector	18	0	7	2	12
Audio cassette player	15	1	7	6	11
Filmstrip projector	17	1	5	4	14
Opaque projector	15	2	2	19	8
16mm film projector	17	0	8	2	1

7. The use of satellite receivers in schools is limited and will not likely play a major role in instruction in agricultural education in the next few years.

8. The greatest barriers to the use of microcomputers in agriculture programs are a lack of funds, expertise, and limited available software.

Implications

Most secondary agricultural education programs in the United States have two microcomputers and printers, a carousel slide projector, overhead projector, audio cassette player, and a filmstrip projector in the inventory of instructional equipment. Conversely, most programs do not have the newer instructional technologies or equipment in the departmental inventory although the school is more likely to have the technology available.

According to the results of this study, less than a fourth of the schools have acquired a satellite receiver dish, amplified telephone, overhead computer projection unit, or large screen television. Slightly over one third of the schools had acquired a microcomputer modem.

Although tremendous advances have been made the availability and feasibility of using instructional technology, secondary agriculture teachers have not kept pace. Funding limitations appear to have severely hampered the infusion of educational technology in secondary agriculture programs. In that regard, funding policies and practices should be reviewed to ascertain the effect of increasing financial support to infuse educational technologies into secondary agricultural education programs.

The respondents in this study indicated that if changes in the level of use of instructional technology were to occur, the change would be to increase its use in the future. Therefore, agriculture teachers appear to be willing to utilize newer instructional technologies.

The videotape player appears to be the audio-visual equipment which teachers plan to use most in the future for group instruction. Therefore, future curriculum development efforts should incorporate videotape supplementary programs to enhance instruction in secondary agriculture programs.

Microcomputers and printers appear to hold the greatest promise for use in program administration and for individualized instruction. Interest in using microcomputers for group instruction is relatively high but secondary to the VCR.

With relatively little interest in microcomputer modems and the cost of telephone toll charges, it is apparent that teachers have yet to embrace information transfer via microcomputer telecommunications. However, taking steps to overcome funding and expertise limitations may encourage greater use of this and other technologies as they become available.

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THE PERCEIVED VALUE OF COMPUTER USE IN SECONDARY AGRICULTURE PROGRAMS: A NATIONAL STUDY[1]

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Teachers can view computers as useful, something to be readily adopted in teaching or they can ignore computers and actively resist the change, as Thornburg (1988) suggested some are doing. Agricultural educators have generally viewed computers positively. Camp, Moore, Foster, and Moore (1988) encouraged students to think of computers as remarkable tools that can make agricultural tasks easier to do, while doing these tasks quickly and accurately. The Committee on Agricultural Education in Secondary Schools (Carlson & Robbins, 1988) recommended that teachers use computer software for instructional applications.

Related Literature

"Our nation is at risk." These words of the National Commission on Excellence in Education (1983, p. 5) clearly challenged this country's educators to take action against mediocrity in education. Among the recommendations to return to a stronger program of basics in education was the commission's endorsement of computer education. Goodlad had taken a similar position in A Place Called School, stating, "[Schools] should assure a measure of technological literacy--especially in computers" (Goodlad, 1984, p. 344).

The Committee on Agricultural Education in Secondary Schools issued a similar recommendation for agricultural educators. "Teachers should seek out and share high-quality computer software and instructional materials . . . for instructional application" (Carlson & Robbins, 1988, p. 5).

The most conclusive evidence supporting the use of computers in education was that provided by Kulik and Kulik (1987). After analyzing 199 comparative studies of computer-based instruction, they concluded that students who used computers generally learned more in less time, liked their classes more, and developed positive attitudes toward computers. Kulik and Kulik summarized by stating that computer-based instruction had positive effects on students but that it has not been uniformly successful in all aspects and at all levels of instruction.

Clark (1986) refuted the work of Kulik and Kulik. He charged that the achievement gains were due to the uncontrolled instructional methods embedded in the [computer-based instruction] treatments. Clark held to the position he had stated in 1983, "The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" (p. 445).

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Bangert-Drowns, Kulik, and Kulik (1985) associated the reluctance to use computers with widespread ignorance about the effectiveness of computers. They concluded from a meta-analysis of 42 controlled evaluations that computer-based instruction had positive effects on student achievement.

Problem Statement

Given the positive attitudes of agricultural educators, the debate between Kulik and Clark prompted several questions. Were agriculture teachers overemphasizing the use of computers? Were they expecting computers to be a magic formula for teaching agriculture? Were computers helping agriculture students learn more in less time? These questions called for the answers to even more basic questions. How were teachers using computers? Did they perceive the use of computers to be valuable in teaching students?

The research problem could be stated in these questions: (a) What software programs were students using as a part of their instructional program? (b) In what agricultural subject areas were students using computers? (c) Did teachers perceive this use to be effective? Answers to such questions could be useful in providing direction to teachers who use computers in their programs.

Objectives

The specific objectives of the study were:

1. To determine demographic characteristics of agriculture teachers related to computer use.
2. To determine which software programs were being used in secondary agriculture programs.
3. To determine the agricultural topics in which students were using computers.
4. To determine the extent to which students were using specified types of microcomputer software programs in specified agriculture topics.
5. To determine the perceived effectiveness of software programs that were being used in agricultural instructional programs.
6. To determine what relationships exist between demographic characteristics of teachers and the amount they use computers and perceive the programs to be effective.

Methods

The population of the study consisted of all the secondary agriculture programs in the United States as listed in the Agriculture Teachers Directory (Henry, 1988). This directory listed 9,093 secondary agriculture programs. Schools were selected by using a proportional stratified sampling method.

The sample size was determined by the calculation of the formula suggested by Hinkle, Wiersma, and Jurs (1988, p. 310). Using an effect size of 0.32 (Kulik, Bangert, & Williams, 1983), the calculated sample size needed was 323 agriculture programs. This was increased to 600 because the response rate was expected to be close to a similar national study by Miller and Kotrlik (1986).

Six faculty members at Iowa State University as well as faculty from other universities reviewed the survey instrument to provide content validity. Reliability was established by pilot testing the instrument with agriculture teachers not in the randomly selected sample. Cronbach's coefficient alpha was calculated to be 0.90 on the pilot test. The internal reliability was calculated to be 0.94 on the instrument when sent to the survey sample.

On March 28, 1989, a computer disk survey instrument was mailed to 600 randomly selected secondary agriculture teachers. On April 17, 1989, a postcard reminder was sent to the teachers who had not yet returned the disk. A paper form of the instrument was mailed on May 1, 1989, to the teachers still not responding. The collection of data was terminated on May 15, 1989. Data collection resulted in a 53.7 percent response rate. However, when surveys of teachers indicating they preferred not to participate were removed, the usable response rate was 44.1 percent. A sample of nonrespondents was surveyed by telephone to determine if the remaining portion of the sample differed from the respondents. Sufficient evidence was not found to consider the nonrespondents as being different from the respondents.

Data were analyzed on SPSSx to determine frequencies, differences, and correlations. Alpha was set at 0.05 for all tests of significance.

Results and Conclusions

Male agriculture teachers made up 93.68 percent of the sample. The profile of a teacher average in all areas would be: 37.13 years of age, 12.28 years teaching experience, 9.84 years teaching at current school, had 2.56 college credits of computer science classes, attended 2.26 computer workshops, worked with computers 4.15 years and owned a computer for 1.83 years. As a group, the teachers rated their abilities highest in word processing and educational games and lowest in programming and telecommunications. Even in the highest area (word processing), however, the mean self-assessed rating (2.63) was between 2.00 (I know enough to get by and 3.00 (I'm somewhat proficient) on a 0 to 5 point scale.

Table 1: Teachers' Years of Experience

Area of experience	N	Mean	S.D.
Age (years)	254	37.13	8.40
Number years taught	255	12.28	7.72
Years taught at current school	255	9.84	7.19
Years of working with microcomputer	256	4.15	2.68
Years of owning a microcomputer	256	1.83	2.57

Table 2: Amount of Teachers' Computer Training

Type of computer training	N	Mean	S.D.
Number of college computer credits	252	2.56	3.52
Number of computer workshops attended	255	2.25	2.19

Table 3: Teachers' Self-assessment of Their Computer Software Abilities

Type of computer software programs	N	Mean[a]	S.D.
Word processing	251	2.63	1.42
Educational games	252	2.33	1.37
Drill and practice	250	1.97	1.53
Spreadsheet	250	1.94	1.33
Data base	250	1.76	1.34
Decision aid	249	1.59	1.45
Graphics	250	1.45	1.39
BASIC programming	251	1.14	1.12
Telecommunications	250	0.99	1.29

[a] Rated on a scale where 0=have not used this program, 1=just a beginner, 2=know enough to get by, 3=am somewhat proficient, 4=am very proficient, and 5=consider myself an expert

As shown in Figure 1, students most frequently used word processing programs. They used this type in 138 of the 256 schools (53.9 percent). This was followed by educational games (133 schools), decision aid programs (121 schools), and drill and practice programs (118 schools). Least used were BASIC programming (used in 32 schools) and telecommunications (49 schools).

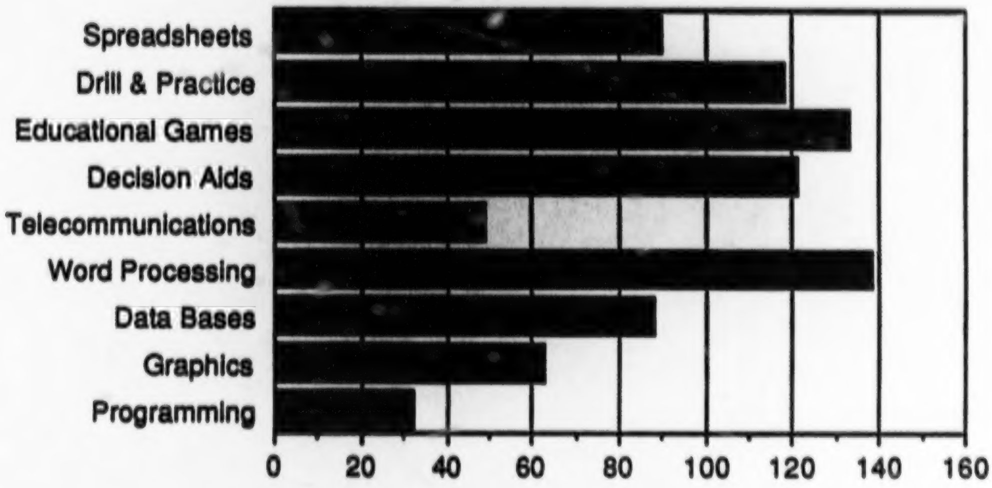

Figure 1. Number of agriculture programs including specified computer software as a part of the instruction.

Students most often used computers in the livestock production area, as can be seen in Figure 2. In 151 of the 157 schools where computers were used and livestock production was taught, students were using computers in this area. This was followed by crop production (135 schools) and agricultural mechanics (121 schools). Computers were used the least in forestry (47 schools).

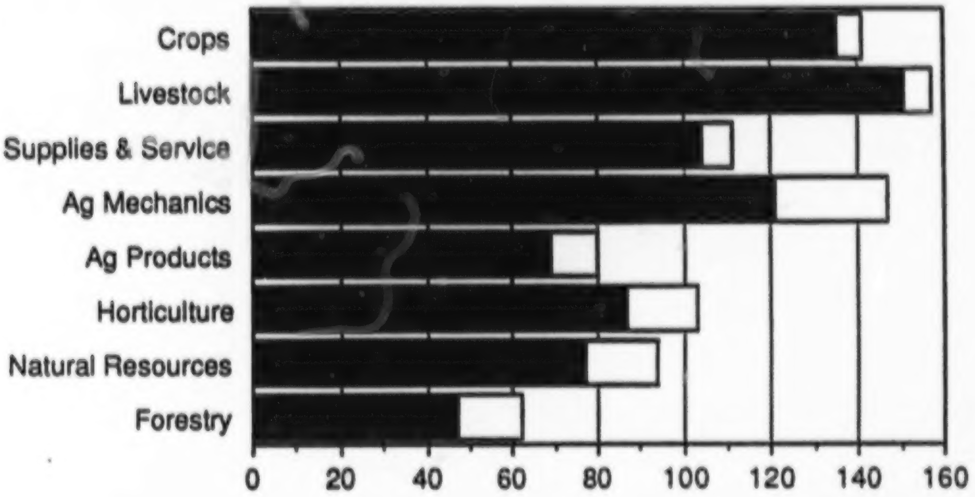

Figure 2. Number of schools teaching agriculture subject areas (total bar) and number of schools using computers in these subject areas (shaded) (n=182 schools where computers were used)

Considering the schools where computers were used and specified topics were taught, the most extensive specific use was decision aid programs in livestock production (see Table 4). The mean of 2.84 fell between seldom (2.00) and moderate use (3.00). One hundred four schools used decision aid programs in livestock production. This was followed by spreadsheet programs used in livestock production (2.82, n=83), decision aid programs used in crop production (2.77, n=93), and drill and practice programs used in horticulture (2.70, n=60). A mean of 2.83 was calculated for the use of BASIC programming in forestry. Only six schools, however, reported using this type of computer application in this area. One hundred seven schools used educational games in livestock production accounting for the most use.

Two factors were considered in assessing the perceived value of five selected types of computer programs: (a) the type of program is motivational and effective in teaching objectives and (b) the type of program wastes time. Table 5 indicates the items loading on each factor as a result of the factor analysis procedure. The teachers responding rated educational games the highest in terms of being motivational and educational. The mean (9.20) fell between moderately agree (9) and strongly agree (10) on a 1 to 11 point scale. This was followed by drill and practice programs (8.56) and decision aid programs (8.25). Teachers also rated educational games most favorably by disagreeing with the factor of educational games being a waste of time. The mean for this factor (3.99) was closest to mildly disagree (4). Telecommunications was rated the least favorably by teachers.

Table 4: Level of Use of Types of Software in Specified Subject Areas

Subject Area		Spread sheet	Drill & Practice	Educ. Games	Decision Aids	Tele-commun.	Word Process	Data Base	Graphics	BASIC Program
Crops	Mean[a]	2.23	2.30	2.33	2.77	2.68	2.12	2.27	2.00	2.00
	S.D.	0.79	0.80	0.97	0.87	1.13	1.01	0.97	0.82	1.04
	(n)[b]	(74)	(83)	(98)	(93)	(37)	(91)	(60)	(31)	(23)
Livestock	Mean	2.82	2.55	2.47	2.84	2.59	2.31	2.40	1.73	2.27
	S.D.	0.91	1.04	1.07	0.88	1.14	1.07	1.06	1.02	1.24
	(n)	(83)	(91)	(107)	(104)	(41)	(96)	(63)	(37)	(22)
Supplies and service	Mean	2.66	2.23	2.35	2.19	2.48	2.57	2.24	2.37	2.25
	S.D.	1.07	1.02	1.12	0.98	1.04	1.17	1.25	1.18	1.07
	(n)	(53)	(61)	(71)	(65)	(25)	(81)	(50)	(27)	(16)
Mechanics	Mean	1.90	2.68	2.17	2.20	1.69	1.91	1.90	2.00	2.46
	S.D.	0.82	1.03	1.06	1.08	1.20	1.00	0.95	1.25	1.27
	(n)	(49)	(80)	(79)	(77)	(16)	(67)	(50)	(29)	(13)
Ag. products processing	Mean	2.13	2.10	2.00	2.09	2.08	2.19	1.94	1.78	1.57
	S.D.	0.98	0.93	0.98	1.00	1.12	1.06	1.19	1.26	1.51
	(n)	(32)	(40)	(43)	(45)	(13)	(47)	(32)	(18)	(7)
Hort-iculture	Mean	2.22	2.70	2.15	2.45	1.82	2.35	2.48	2.52	2.22
	S.D.	0.93	1.83	0.92	1.15	0.98	1.06	1.46	1.20	1.03
	(n)	(27)	(60)	(54)	(53)	(11)	(55)	(29)	(23)	(9)
Natural Resources	Mean	1.93	2.17	2.49	2.17	1.83	2.12	1.71	1.53	2.00
	S.D.	1.14	1.00	1.23	1.11	1.19	0.99	0.96	0.74	1.21
	(n)	(27)	(48)	(49)	(41)	(12)	(51)	(24)	(15)	(12)
Forestry	Mean	2.05	2.48	2.35	2.22	2.60	2.18	2.05	2.36	2.83
	S.D.	0.87	1.12	1.05	1.05	1.82	1.10	0.97	0.92	1.17
	(n)	(21)	(29)	(29)	(27)	(5)	(33)	(21)	(11)	(6)

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[a] Level of use rated on a scale where 1=rarely, 2=seldom, 3=moderate, 4=heavy, and 5=extensively

[b] Number of the 256 departments using software in specified subject

Table 5: Factor Loadings for Software Value Statements

Factor/statements	Loading
Factor 1: Software is motivational and educational	
Software motivates students to learn	0.84
Students enjoy using this software	0.82
Students are willing to spend extra time working with this software	0.74
Software increases students' ability to understand material	0.70
Software can easily be used by all students	0.69
Software helps accomplish teaching objectives	0.69
Factor 2: Software wastes students' and teachers' time	
Software requires too much of the student's time	0.80
Software requires too much teacher preparation time	0.79
Software is frustrating for students to use	0.76

Table 6: Factors Relating to Perceived Value of Selected Types of Software

Factor/type of software	N[a]	Mean[b]	S.D.
Software is motivational and educational			
Spreadsheets	90	7.55	1.54
Drill and practice	116	8.56	1.15
Educational games	131	9.20	1.06
Decision aids	120	8.25	1.22
Telecommunications	49	7.23	1.67
Software wastes students' and teachers' time			
Spreadsheets	90	5.28	2.05
Drill and practice	116	4.08	1.61
Educational games	131	3.99	1.69
Decision aids	120	4.64	1.78
Telecommunications	49	6.03	2.37

[a] Number of departments where students used software as a part of their agriculture classes

[b] Rated on a scale where 1=very strongly disagree, 2=strongly disagree, 3=moderately disagree, 4=mildly disagree, 5=very mildly disagree, 6=neither agree nor disagree, 7=very mildly agree, 8=mildly agree, 9=moderately agree, 10=strongly agree, and 11=very strongly agree

Table 7: Correlations between demographic characteristics and the amount students use specified types of computer programs

Type of program		Years taught	Years of computer ownership	No. of computer credits	No. of computer workshops
Spreadsheet	r	0.26**	0.12	-0.00	0.08
	(n)[a]	(90)	(90)	(88)	(89)
	prob.	0.00	0.13	0.49	0.22
Drill and practice		0.05	0.02	0.13	0.01
		(115)	(115)	(112)	(114)
		0.31	0.42	0.09	0.45
Educational games		0.05	-0.01	0.17*	-0.14
		(130)	(130)	(128)	(129)
		0.30	0.46	0.03	0.06
Decision aids		0.20*	0.14	0.05	0.08
		(119)	(119)	(117)	(118)
		0.02	0.07	0.29	0.18
Telecommunications		-0.04	-0.04	0.02	-0.15
		(47)	(47)	(47)	(47)
		0.40	0.39	0.45	0.15
Word processing		0.15*	0.06	0.08	0.00
		(135)	(135)	(133)	(134)
		0.04	0.25	0.17	0.48
Data Base		0.13	0.23*	0.12	0.10
		(87)	(87)	(86)	(86)
		0.11	0.02	0.14	0.18
Graphics		0.22*	0.10	0.20	0.01
		(62)	(62)	(61)	(61)
		0.04	0.23	0.06	0.48
BASIC programming		0.03	-0.15	-0.05	-0.26
		(31)	(31)	(29)	(30)
		0.44	0.21	0.40	0.21

*Significant at the 0.05 level

**Significant at the 0.01 level

[a] Number of schools where students used specified programs

The Pearson product moment correlation was used to determine if relationships existed between demographic variables and computer use. Significant, but weak, positive correlations were found to exist between years of teaching and the extent students used spreadsheets (r=.26), decision aid programs (r=.20), and graphics programs (r=.22). A significant positive relationship was also found between the number of years a teacher owned a computer and the extent to which students used data base programs (r=.23).

Table 8: Correlations between teacher's rating of the factor "Software is motivational and educational" and the amount students use selected types of computer programs

Type of program		Years taught	Years of computer ownership	No. of computer credits	No. of computer workshops
Spreadsheet	r	0.25**	0.01	0.02	0.03
	(n)[a]	(90)	(90)	(88)	(89)
	prob.	0.01	0.46	0.44	0.38
Drill and practice		0.18*	0.01	-0.02	-0.05
		(116)	(116)	(113)	(115)
		0.03	0.47	0.41	0.31
Educational games		0.06	-0.19*	0.08	-0.13
		(131)	(131)	(129)	(130)
		0.26	0.02	0.18	0.07
Decision aids		0.06	0.04	0.11	-0.11
		(120)	(120)	(118)	(119)
		0.26	0.35	0.11	0.18
Telecommunications		0.05	-0.17	0.15	0.08
		(49)	(49)	(48)	(49)
		0.36	0.12	0.16	0.30

*Significant at the 0.05 level
**Significant at the 0.01 level
[a] Number of schools where students used specified programs

Weak positive correlations were found between years of teaching compared with the teachers' agreement that spreadsheet and drill and practice programs were motivational and educational. A weak negative correlation was found between years of teaching and the teachers' agreement that decision aid programs were a waste of time. Finally, a weak negative correlation existed between years of owning a computer and teachers' agreement that educational games were motivational and educational. At the same time there was a weak positive correlation between years of owning a computer and teachers' agreement that educational games were a waste of time.

Table 9: Correlations between teacher's rating of the factor "Software is a waste of student' and teachers' time" and the amount students use selected types of computer programs

Type of program		Years taught	Years of computer ownership	No. of computer credits	No. of computer workshops
Spreadsheet	r	-0.07	0.14	0.00	-0.07
	(n)[a]	(90)	(90)	(88)	(89)
	prob.	0.24	0.09	0.49	0.27
Drill and practice		-0.10	0.10	0.06	-0.16*
		(116)	(116)	(113)	(115)
		0.15	0.15	0.27	0.04
Educational games		-0.05	0.22**	0.09	-0.00
		(131)	(131)	(129)	(130)
		0.29	0.01	0.16	0.49
Decision aids		-0.20**	-0.09	0.01	-0.14
		(120)	(120)	(118)	(119)
		0.01	0.15	0.44	0.07
Telecommunications		0.00	-0.08	0.00	-0.11
		(49)	(49)	(48)	(49)
		0.50	0.28	0.49	0.23

*Significant at the 0.05 level
**Significant at the 0.01 level
[a] Number of schools where students used specified programs

Implications

The following implications were derived from the conclusions:

1. The use of computers by agriculture teachers is still relatively new with the group mean being less than five years of computer experience. Most teachers rated themselves no higher than just able to get by in their ability to use specific programs. This was not consistent with the recommendations of the National Commission on Excellence in Education and the Committee on Agricultural Education in Secondary Schools. If students are to increase their use of computers, teachers need to improve their own computer skills. More education is needed if teachers are to keep up with the use of computers.
2. Computer programs most often used were word processing, educational games, decision aid programs, and drill and practice programs. Note that a slight correlation existed between years of owning a computer and teachers' agreement that educational games were a waste of time. The researchers pose these questions for consideration: Did teachers with more computer experience view games as being of less value and application programs as being of more value? Did other teachers view educational games and drill and practice programs as being valuable because these teachers were more competent at operating these

programs? And finally, in a curriculum where problem solving and critical thinking are stressed, should problem solving computer programs such as spreadsheets, data bases, and decision aid programs be used more than educational games and drill and practice programs? The researchers suggest consideration of increased use of computer programs such as spreadsheets and data bases to teach problem solving with computers.

3. Computers were being used more often in agricultural production areas then in other agricultural subject areas. However, agricultural production was taught in more schools then were other subject areas. In a time when few graduates are returning to farming, consideration should be given to using computers more often in other agricultural subject areas. The researchers encourage the development of good computer programs and lesson plans to use computers in all agricultural subject areas.
4. Data concerning the level of use of types of software are difficult to interpret. For example, a mean level of 2.83 for BASIC programming in forestry can be compared with 2.84 for the use of decision aids in livestock production. But, decision aids in livestock production were used in 104 schools whereas BASIC programming in forestry was used in only six schools. Computer programs, particularly educational games and decision aids, were used the most in livestock production. Computer programs were also used frequently in crop production. It should be noted, however, that these subject areas were most frequently taught in the schools sampled. This implies that there were a number of applications for computer programs in these subjects. It should not be interpreted to mean that computer programs are not suited for use in agricultural subjects.
5. Teachers rated educational games the highest for being motivational and educational. However, teachers who owned computers for more years did not rate this type of program as high. It seems that, as one owns a computer longer, that person sees less value in computer games. The implication is that although educational games are motivational, they should be used cautiously and not be overused.
6. Teachers were positive about the value of the use of the five selected types of software. They generally agreed that these computer programs were educational and motivational. They generally disagreed with the idea that these programs were a waste of time. However, they were more divided when considering spreadsheet and telecommunications as a waste of time. In these cases, the group mean was closer to "neither agree nor disagree" but the variance was greater compared with the consideration of the other types of software. By contrast, educational games and drill and practice programs were viewed positively by teachers as they disagreed with the idea that these programs were a waste of time. The researchers believe that because educational games and drill and practice programs are easier to use, the implication is that the simplicity of operation has a bearing on the perceived value of computer programs. The researchers suggest an increase in knowledge and use of computer programs that will stimulate critical thinking and the problem solving abilities of students.
7. Few relationships were found to exist between demographic variables such as age, gender, and years of teaching compared with computer use and perceptions of computer use. Relationships that did exist were weak correlations. Such demographic variables need not be considered important when planning in-service training or planning to include computers in a secondary agriculture curriculum.

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CURRICULUM AND CAREER MATURITY: A CRITIQUE

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The purpose of this study was to measure the career maturity of senior high school students, and to determine the relationship between curriculum and career maturity. To examine the research purpose, the researchers established the following null hypotheses:

1. There will be no relationship between curriculum and career maturity.

2. If mental ability, scholastic achievement, social economic status, educational aspiration, and vocational aspiration are statistically controlled; there will be no relationship between curriculum and career maturity.

This study is significant to agricultural education for a number of reasons. As many of us know, the philosophy, goals, and evaluation of vocational education are dominated by the issue of job placement after program completion. In outlining the problem, the researchers identified a very important question and the question is: "Are students ready to make these career decisions at this point of their life?" The authors presented an extensive review of literature and research relative to this study, and their research will provide additional information for an issue that should be given a higher priority as part of the secondary education delivery system.

I want to commend the researchers for the design of this study. Based on their design, this study could be replicated in other states or a consortium of states. The appropriate statistical analyses were used and these analyses were clearly presented in the paper. The researchers are to be commended for the way in which the research findings were reported in the paper. More importantly, the researchers did an excellent job of summarizing the study with a particular focus on the implications.

Two points for consideration by the researchers are related to the title of the paper and the primary instrument used. The title of the paper could have been more descriptive in nature. Considering the Career Development Inventory developed by Thompson and others in 1981 and used in this study, it would have been helpful to know the process used in validating the instrument. Other than these minor concerns, this was a scholarly conducted study and I commend the researchers for their professional contributions.

CURRICULUM TECHNOLOGY IN SECONDARY AGRICULTURE PROGRAMS: A CRITIQUE

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The purpose of this study was to assess the extent to which instructional technology has been and will be utilized in secondary programs of agricultural education in the United States. The objectives focused on type and quantity of instructional technology, the extent to which future plans differed from current use of instructional technology, and the barriers which inhibit greater use of instructional technology.

In light of all the articles, studies, and discussions relative to instructional technology, this is a timely national study. As was mentioned by the researchers, this study should be of particular interest to decision-makers as they attempt to facilitate the infusion of educational technology in classrooms of tomorrow. Simply stated, instructional technology may be a high priority of decision-makers. However, in the absence of accurate data from teachers themselves, innovative instructional technology plans may be very difficult to implement.

The researchers are to be commended for including in the paper some to the pertinent research that has been done on this topic. I also commend the researchers for the procedures used in the study. This includes the sampling procedures, pilot testing of the instrument, determining instrument reliability, data collection, and follow-up on non-respondents.

The appropriate statistical analyses were used in analyzing the data and the findings were appropriately included. In reviewing the conclusion section, I do question conclusion number 3 which states, "The population of agriculture teachers is less likely to use microcomputer-related materials than are the teachers responding to this survey." What is the basis for this conclusion? In the implications section of the paper, the authors stated, "Although tremendous advances have been made the availability and feasibility of using instructional technology, secondary agriculture teachers have not kept pace." In making this statement, are you comparing agricultural teachers with other vocational teachers, secondary education teachers, the agricultural industry, or some other criteria?

In summary, this is a very timely, well designed, and scholarly effort. In light of the technological age that is upon us, this study should be of particular interest to the agricultural education profession and key decision-makers.

THE PERCEIVED VALUE OF COMPUTER USE IN SECONDARY AGRICULTURE PROGRAMS: A NATIONAL STUDY

A CRITIQUE

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The researchers of this national study have focused on a very important topic by attempting to determine the perceived value of computer use in secondary agriculture programs. In examining the review of literature and research, they clearly identified some differences with repect to the value of computer-based instruction. They reported that Clark (1983) strongly believed that media such as computer-based instruction are mere vehicles for delivering instruction but do not influence student achievement. On the other hand, the researchers reported that other researchers (Bangert-Drowns, Kulik, and Kulik) have concluded that computer-based instruction had positive effects on student achievement. The researchers identified the following questions as being directly related to the problem investigated.

1. What software programs were students using as a part of their instructional program?
2. In what agricultural subject areas were students using computers?
3. Did teachers perceive this use to be effective?

I commend the researchers for providing additional information relative to the topic of computer-based instruction. Even though the agricultural education profession has given this issue a higher priority over the last five or more years, a tremendous amount of work has to be done in this area.

The researchers are to be commended for the methodologies used in this study including the sampling procedures, establishing content validity and determining reliability of the instrument, data collection, and follow-up of non-respondents. You are to be commended for presenting the findings and conclusions in the paper in à very scholarly manner. The implications section of the paper was very thought-provoking in that the points discussed by the researchers are some of the real issues which must be addressed by the profession. For an example, the respondents indicated that they had about five years of experience in working with computers. Yet most of the teachers rated themselves no higher than just able to get by in their ability to use specific programs. This finding alone clearly indicates the challenge facing the profession with respect to computer-based instruction. The researchers are to be commended for conducting a well designed and timely study.

INSTITUTIONAL FACTORS ASSOCIATED WITH THE LEVEL OF PARTICIPATION IN ADULT AGRICULTURAL EDUCATION PROGRAMS

by

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INTRODUCTION

Adult education programs are designed to serve the adult clientele. The existence of adult education programs is determined to a large extent by whether or not adults participate in the programs. Much of the research in adult education concerns the participation of adults in organized instruction (Houle, 1963; Johnstone and Rivera, 1965; Anderson and Darkenwald, 1979; Cross, 1981; Darkenwald and Merriam, 1982; Charner and Fraser, 1986). The research has emphasized situational and psychosocial barriers to participation, often overlooking institutional barriers. Research in adult education in agriculture fits this description also. Particularly lacking in agricultural education research is investigation of the impact of institutional barriers on the level of participation in adult agricultural education programs.

PURPOSE AND OBJECTIVES

One purpose of the research reported in this paper was to study the level of participation in adult agricultural education programs. The specific objectives were to investigate the relationship between the level of participation and the following in schools with adult agricultural programs: 1) the perceptions of superintendents, principals, and secondary vocational agriculture instructors toward the benefit, need, funding, and operation of an adult agricultural education program; 2) the provisions of local school policy pertaining to the adult agricultural education program; 3) teaching experience of superintendents, principals, and instructors; 4) the Young Farmer program; 5) the secondary educational program; 6) program planning; 7) fees charged for the adult program; and 8) the activeness of other adult education programs.

PROCEDURES

The population was all secondary schools in Ohio that offered vocational agriculture programs in agricultural production or farm business management during 1985-86 and receiving reimbursement from the Ohio Department of Education for adult programs in production agriculture or farm management. Since data were collected during the 1986-87 school year, schools constituting the frame were those in which the superintendent, principal, and vocational agriculture instructor(s) in 1986-87 were the same individuals as in 1985-86. Consequently, the frame consisted of 89 schools meeting this criteria. A simple random sample of 42 schools was drawn.

Data were obtained from researcher-designed questionnaires and from official records in the Ohio Department of Education. Content validity of the questionnaires was established by a panel of experts. The questionnaires were pilot tested with a group of superintendents, principals, and vocational agriculture instructors in schools not included in the sample. Cronbach's alpha coefficients for the attitude scale items were .87 for superintendents, .81 for principals, and .76 for vocational agriculture instructors.

Data from superintendents, principals, and vocational agriculture instructors were collected by mail questionnaire using procedures suggested by Dillman (1978). Of the 126 questionnaires mailed, 83 percent were returned. Since the unit of analysis was a school, complete data for a school required that usable questionnaires be returned from the superintendent, principal, and at least one vocational agriculture instructor in the school. Complete data, including usable questionnaires and data from records in the Ohio Department of Education, were available for 26 of the 42 schools offering adult agricultural education programs.

For responses to questionnaire items; early, middle, and late respondents were compared with no significant differences between groups. Responses to the questionnaire of respondents from complete-unit schools (superintendent, principal, and vocational agriculture instructor responded) were compared to respondents from schools where one or more of the individuals did not respond. This analysis did not reveal significant differences in the responses of superintendents, principals, or instructors between complete-unit schools and noncomplete-unit schools. Also, complete-unit schools were compared to noncomplete-unit schools on data collected from Ohio Department of Education records. These comparisons indicated no significant differences between the schools used in the analysis (complete-unit schools) and schools not used in the analysis (noncomplete-unit schools). The analyses reported in this paragraph indicate that nonresponse to the mail questionnaire is not a major threat to the external validity of the study.

RESULTS

Level of Participation

The level of participation in adult agricultural programs ranged from 12 to 257. The mean number of participants was 44 (sd=46), the median was 39, and the mode was 48.

Perceptions of Superintendents, Principals, and Instructors

The group of attitude variables included 14 variables: attitudes of superintendents, principals, and instructors about the benefits, need, funding, and operation of adult programs. Superintendents, principals, and instructors in general indicated that adult agricultural programs are a benefit to the community, school, the participants, and the instructor. Analysis of variance indicated no significant differences between superintendents, principals, and instructors on their response to the benefit domain statements. The correlation between the level of participation and the responses to the benefit statements of superintendents (.26), principals (.25), and instructors (.19) were all low and not significant.

Concerning the statements asking if there was a need for an adult agricultural education program superintendents, principals, and instructors all indicated that adult agricultural programs in the school district were needed. Analysis of variance indicated no significant differences between superintendents, principals, and instructors on their response to the need domain statements. The correlation between the level of participation and the responses to the need statements of superintendents (.04), principals (.14), and instructors (.20) were either negligible or low, and not significant.

The next domain of interest pertained to the funding of adult agricultural programs. Superintendents tended to indicate that the adult participants should assume some of the financial responsibility toward supporting the adult program while principals either disagreed or were neutral toward the adult clientele paying fees for the adult program. Instructors indicated that the adults should not pay any fees for participating in the adult program. Analysis of variance indicated that there were significant differences between the instructors' perceptions and those of superintendents and principals. The correlation between the level of participation and the responses to the funding of the adult program of superintendents (-.13), principals (-.18), and instructors (-.21) were all negative, low and not significant.

The final domain of interest addressed the operation of the adult program. This domain included the technical and professional competency of the instructor, that the instructor has the time and should be the one to teach the adults, and that the adult education program should serve the entire agricultural community. Superintendents, principals, and instructors were in agreement with these statements. Analysis of variance indicated no significant differences between superintendents, principals, and instructors on their response to the operation domain statements. The correlation between the level of participation and the responses to the operation of the adult program of superintendents (.27), principals (.16), and instructors (.27) were all low and not significant.

In addition to these four attitude domains, the instructors were asked to respond to a series of statements pertaining to external and personal factors that influence a vocational agriculture instructor to conduct an adult education program. The majority of the instructors indicated that there were external and internal factors that influenced their directing the learning of adults. The correlation between the level of participation and the external factors was moderate (.35) and not significant, and the correlation between the level of participation and personal factors was negligible (.02) and not significant.

District and School Policy for Adult Programs

The second objective concerned the provisions of local policy pertaining to the adult agricultural program and to the instructor of the adult program. A policy index (Figure 1) was developed from questions addressing whether or not policy existed and if it did was it written district or local policy, or was it non-written district or local policy. In addition to these questions the agreement of the principal and instructor with the response of the superintendent and the agreement of the instructor with the principal was built into the index. The index ranged from 1 indicating no policy to 7 indicating that there was district and local school policy pertaining to the adult program and the instructor's role in the program.

Policy Index	Adult Program District Policy	Adult Program School Policy	Instructor District Policy	Instructor School Policy
7	XXX	XXX	XXX	XXX
6	XXX	XXX	XXX	
5	XXX		XXX	
4	XXX		XXX	
3	XXX			
2	XXX			
1				

[For schools to be included in a particular category indicated by "XXX" in the above figure the following conditions must be true:
(1) For district policy: (a) the superintendent must indicate there is policy, and
(b) at least the principal or instructor must agree with the superintendent.
(2) For school policy: (a) the principal must indicate that there is policy, and
(b) the instructor must agree with the principal.]

Figure 1

Presented in Table 1 are the results of the policy index pertaining to the adult program and vocational agriculture instructor. Overall, the superintendents, principals, and instructors indicated that they have policy, either written or non-written but generally understood, that addresses the adult program or the instructor teaching adults. A correlation coefficient of -.21 indicates a negative, low relationship between the type and extent of policy present, and the level of participation.

TABLE 1

Policy Pertaining to the Adult Program and the Vocational Agriculture Instructor

Policy Index	Frequency	Percent
1	9	34.7
2	1	3.8
3	1	3.8
4	4	15.4
5	7	26.9
6	1	3.8
7	3	11.6
Total	26	100.0

1=Superintendent, principal, and instructor agree there is district policy, and principal and instructor agree there is school policy.
7=Superintendent, principal, and instructor indicate there is no policy.

Recent Adult Teaching Experience

The third objective investigated the recent exposure to teaching adults and the receiving of instruction pertaining to adult education. Instructors were asked the number of years they had taught agriculture and the number of years they had taught adults.

The majority of the superintendents and principals had not recently taught adults, while all of the instructors had recently been involved in directing the learning of the adult clientele. The correlation between the level of participation and recent adult teaching experience of superintendents (.-16) and principals (.22) were moderate and not significant. The majority of the superintendents, principals, and instructors indicated that they had recently received some form of instruction in teaching or administering adult education programs. The correlation between the level of participation and recent instruction pertaining to adult education programs of superintendents was moderate (.48, $p<.01$). Principals and instructors correlations were also moderate (.31) but not significant.

Vocational agriculture instructors had a mean number of years teaching agriculture of 15 (sd=7.5) and a mean number of years teaching adults of 13 (sd=7.8). The correlation coefficient of the level of participation and the number of years experience the instructor has teaching agriculture and teaching adults was negligible (.07 and .08 respectively), and not significant.

Young Farmer Program

The fourth objective pertains to the existence of a Young Farmer program, the number and age of the participants, the number of meetings, and the number of hours of instruction received. There was an average of 14 participants under the age of 35 and an average of 13 above the age of 35. These programs generally met formally 9 times during the year with an average total number of hours of instruction, both formal and informal, being 70. The correlation between the level of participation and the number of participants in the Young Farmer program was very high (.81) and significant ($p<.01$). Correlations between the level of participation and the age of participants, number of times met, and the hours of instruction were low and not significant.

Scope and Nature of the Secondary Agricultural Program

The fifth objective addresses the secondary vocational agriculture program. The amount of time that the instructor may have available to teach adults may be limited due to the secondary program. The scope and nature of the secondary program consisted of the secondary enrollment, number of student visits, and the activeness of the secondary program's youth organization (FFA). The correlations between the level of participation and the secondary program variables were all low or negligible, and not significant.

Program Planning

The program planning factors of involvement of an advisory committee and the adult clientele in planning the program, the conducting of a needs assessment, and claiming the Young Farmer program as the adult program were combined into a program planning index. This index ranges from 0, indicating no use of available resources in planning the adult program to 6, which indicates the use of all the listed resources in planning the adult program. The mean program planning index value was 3.4 (sd=1.4); the median and mode were 4.0. A Pearson correlation coefficient of .02 indicates no significant relationship between the use of available resources in planning the adult program and the level of participation in the adult agricultural program.

Charging of Fees to the Adult Clientele

The majority of the adult programs did not charge the clientele fees to participate in the adult agricultural program. The correlation between the level of participation and the charging of fees was negative and low (-.05), and not significant.

Activeness of Local Organizations in Providing Adult Agricultural Education Activities

The final objective concerns the activeness of agricultural organizations, colleges, universities, industry, commercial interests, governmental agencies, post secondary institutions, other area high schools, religious organizations, technical institutes, and the Cooperative Extension Service in providing adult agricultural education activities. The instructors indicated that all except the Cooperative Extension Service provided the same or less educational activities as did the adult agricultural program. A correlation coefficient of .10 indicated that there is no significant relationship between the activeness of local organizations, agencies, and institutions, compared to the adult agricultural programs, in providing adult agricultural education activities and the level of participation in adult agricultural programs.

Regression Analysis

Each major group of variables was entered into a stepwise multiple regression analysis to determine the variables with the highest explanatory ability. The only variable identified by the regression models as having significant predicting ability is the receiving of instruction in teaching or administering an adult program by the superintendent.

CONCLUSIONS AND RECOMMENDATIONS

The following is concluded about the results of this investigation.

- Superintendents, principals, and instructors are in general agreement among each other that adult agricultural education programs are a benefit to the community, school, participants, and the teacher.

- Superintendents, principals, and instructors are in general agreement among each other that adult agricultural education programs are needed in the school district.

- Superintendents, principals, and instructors are in general agreement among each other that the adult clientele should assume some of the financial responsibility for participating in adult agricultural education programs, however there were definite differences between instructors, principals, and superintendents concerning the specific statements about the funding of the adult programs.

- Superintendents, principals, and instructors are in general agreement among each other that the vocational agriculture instructor is competent to teach and should teach the adult agricultural education program.

- Superintendents, principals, and instructors are in general agreement among each other that there exists some form of policy that addresses adult education programs and the instructor's role in this program.

- Superintendents, principals, and instructors have for the most part recently received some type of instruction in teaching or administering adult education programs.

- There is a definite relationship between the number of participants in the Young Farmer program and the number of participants in the adult agricultural education program.

- The scope and nature of the secondary vocational agricultural program, the planning of the adult program, the charging of fees, and the involvement in adult education activities of other organizations and agencies does not influence the level of participation in adult programs.

- None of the variables investigated significantly explained variability in the level of participation in an adult agricultural program.

These conclusions lead to the following recommendations.

- In Ohio, state department of education personnel and teacher educators should direct resources toward the strengthening of Young Farmer programs.

- Future investigations into the level of participation in adult agricultural programs as well as other adult education programs should include institutional variables in order to further determine their influence on the level of participation.

- Identification of the factors that motivate adults to participate in agricultural education programs should be a component of future adult participation studies.

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GENDER BASED PERCEPTIONS TOWARDS FEMALE TEACHERS OF AGRICULTURE

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INTRODUCTION

Over the years, socio-economic changes, legislation, and court decisions have mandated nondiscriminatory practices in education. As a result, women began to consider educational occupations that had traditionally been male intensive (Ries, 1980). The teaching of agricultural education, which had traditionally been a male occupation, became a career option for women.

Despite slight increases in the number of female teachers of agriculture (Knight, Henderson, & Ries, 1980; Knight, 1987; Whittington, 1988; Moore, Kite, & Thomas, 1979; Ries, 1980), enrollment of females in preservice teacher programs of agricultural education continued to be low (Ries, 1980; Knight, Henderson, & Ries, 1980; Kane, 1978; Knotts & Knotts, 1975). Knotts and Knotts (1975) speculated that prevailing social attitudes, sex-stereotyped counseling, early conditioning, and institutional policies contributed to the low enrollment of females in agricultural education.

Significant factors which contribute to the success or failure of a female in nontraditional employment has been the pressure or support received from co-workers, family, and friends (United States Department of Labor, 1978), and level of perceived discrimination and sexual harassment (Knight, 1987). Kane (1978) and Knight et al. (1980), suggested that the major concern shared by women who teach vocational agriculture was acceptance by their co-workers, namely the male vocational agriculture teachers. Knight (1987) stated that female teachers of agriculture reported discrimination against them at some point in their careers by administrators and other male vocational agriculture teachers. Additionally, one third of the female teachers (Knight, 1987) reported to have been harassed by administrators and other male vocational agriculture teachers.

In addition to collegial support, subtle discrimination, and sexual harassment, other factors enter into a person's career choice (Knotts & Knotts, 1975). In a survey conducted by Gregg, Hampton, and Juergenson (1975), it was concluded that "women do not have any more problems in the classroom than men and that contrary to common belief, women are accepted in the community, even though in most areas, agriculture teaching is still considered to be a man's profession" (page 272).

Teachers play a tremendous socializing role in American culture and are a key in changing student concepts regarding sex role expectations (Kaplan, 1975; Matthews & McCune, 1975; Ricks & Pike, 1973). Ricks and Pike (1973) reported that perceptions and attitudes of teachers towards sex roles are traditional, and presumably contribute to maintaining restrictive sex role expectations.

PURPOSE AND OBJECTIVES

The purpose of this descriptive study was to determine the male vocational agriculture teachers' attitude and perception towards female vocational agriculture teachers in Ohio. Specifically, attitudes of the male vocational agriculture teachers towards female vocational agriculture teachers in the areas of job competency and leadership qualities were studied. In addition, the perception towards female vocational agriculture teachers in the areas of sexual discrimination, sexual bias, and sexual harassment were also studied.

The following research questions were investigated:

1. How can the male vocational agriculture teachers be described on selected demographic variables?
2. What is the perception of male vocational agriculture teachers toward female vocational agriculture teachers in terms of leadership qualities and leadership positions within the professional organization?
3. What is the perception of male vocational agriculture teachers toward female vocational agriculture teachers in terms of job competency (classroom management, classroom instruction, laboratory instruction, and the teaching in selected taxonomies)?
4. To what extent is there perceived sexual discrimination, sexual harassment, and sexual bias towards the female teachers of agriculture by selected groups as reported by the male vocational agriculture teachers?

PROCEDURES

Population and Sample

The population for this study was all male vocational agriculture teachers in Ohio (N = 513). The sample consisted of a census of male vocational agriculture teachers in the taxonomies of Agricultural Business (N = 29), Farm Business Planning and Analysis (FBPA) (N = 27), and Natural Resources (N = 13). Utilizing Cochran's formula (5% chance of error), a random sample of male vocational agriculture teachers in Agricultural Mechanics (N = 81, n = 70), Horticulture (N = 71, n = 60), and Production Agriculture (N = 292, n = 170) were selected. The total sample constituted of 369 male vocational agriculture teachers.

Instrumentation

Instrumentation consisted of a mailed questionnaire developed by the researchers. Questions on the instrument were derived following a review of literature and corresponded to the objectives of the study. The instrument consisted of one part each for leadership, job competency, adult education, demographics, and sexual discrimination, bias, and harassment. Data on selected leadership questions, job competency, sexual discrimination, sexual bias, and sexual harassment were collected utilizing a 10 point (1 = strongly disagree, 10 = strongly agree) Likert scale.

The instrument was reviewed for content validity by a panel of experts which consisted of teacher educators, graduate students, and male teachers of agriculture. The instrument was pilot tested for reliability using male vocational agriculture teachers not selected for the study. The reliability score using Cronbach's alpha was .89.

Data Collection

Data were collected following criteria established by Dillman (1978). Post cards announcing the forthcoming questionnaire package were mailed five days prior mailing the complete questionnaire package which consisted of a cover letter, questionnaire, and stamped return envelope. Follow-up consisted of a post-card sent to non-respondents ten days after the mailing of the first complete package. A second complete package (cover letter, questionnaire, and stamped return envelope) was mailed to non-respondents seven days after the first follow-up post-card. A final follow-up post-card was mailed five days after the mailing of the second complete package. There were 269 responses (73%) of which 238 (65%) were usable. Non-response error was controlled by comparing early to late respondents, which yielded no significant differences.

Analysis of Data

All data were analyzed using descriptive statistics. The Statistical Package for the Social Sciences, Personal Computer version (SPSS^{x}PC) was used to analyze the data.

RESULTS

Demographic Variables

The results indicated that the male vocational agriculture teachers had a mean of 13.5 years of teaching, a mean age of 41 years, and the majority (78%) taught in rural or small towns (population less than 25,000). In addition, 80% of the male teachers were married, the majority (56%) taught in comprehensive high schools and 77% had attained at least a bachelor's degree. Furthermore, 72% of the teachers had pursued a four-year degree with a major or dual major in agricultural education. In terms of teaching taxonomy, 9% taught agribusiness, 16% agricultural mechanics, 8% FBPA, 15% horticulture, 3% natural resources, and 49% production agriculture.

Leadership Qualities and Positions

In the area of leadership qualities and leadership positions, 34% of the males had held a district level Ohio Vocational Agriculture Teachers Association (OVATA) officer position (Table 1), whereas 4% of the females had held similar positions (Whittington, 1988). Eight percent of the male teachers reported nominating a female candidate for a district level officer position in OVATA. Furthermore, 32% indicated they had voted for a female teacher for a district level OVATA office.

Table 1

Percent of Male Vocational Agriculture Teachers Categorized on Selected Leadership Characteristics (n = 238)

Characteristic	District Level %	State Level %
Held OVATA officer position	34	13
Nominated female for OVATA officer position	8	4
Voted for female for OVATA officer position	32	12

At the state level, 13% of the males had held a state level OVATA office, whereas less than one percent of the females had held similar positions (Whittington, 1988). Four percent of the males indicated that they had nominated a female for a state level officer position within the professional state organization. At the state level, 12% of the males indicated that they had voted for a female candidate for a state OVATA office.

The percentage of male teachers who indicated they would vote for a qualified female for a state level officer position within the professional organization are the following: Secretary (97%), Treasurer (94%), Vice-President (92%), President-Elect (91%), and Chaplain (89%) (Table 2). Similarly, the percentage of male teachers who indicated that qualified females were capable of holding state level officer positions were: Secretary (99%), Treasurer (97%), Vice-President (96%), President-Elect (95%), and Chaplain (94%).

Table 2

Percent of Male Vocational Agriculture Teachers Who Indicated They Would Vote For and Who Indicated Females Were Capable of Holding Selected Officer Positions
(n = 236)

Officer Position	Would Vote %	Capable of %
President-Elect	91	95
Vice-President	92	96
Secretary	97	99
Treasurer	94	97
Chaplain	89	94

Note: 2 missing cases

In addition, the male teachers were in strong agreement (9.53), on a scale of 1-10 (10 being strongly agree and 1 being strongly disagree), that qualified female teachers were competent to hold officer positions at the district and state level (Table 3). However, the male teachers were in slight agreement (6.31) that female teachers were strong leaders.

Job Competency

In regard to job competency, classroom management received a mean score of 6.14 (slight agreement); classroom instruction, 7.08 (some agreement); and laboratory instruction, 5.53 (very slight agreement). Overall, there was some agreement (7.36) that female teachers were competent teachers of agriculture.

In regard to which taxonomy females should teach, the male teachers indicated females should teach in the following rank ordered taxonomies: (Table 4) horticulture, animal care, food processing, agribusiness, natural resources, FBPA, production agriculture, and agricultural mechanics.

Discrimination, Bias, and Harassment

The male teachers strongly agreed that they understood the meaning of sexual discrimination (9.34), sexual bias (8.98), and sexual harassment (9.23). In addition, the male teachers indicated they were familiar with the context in which sexual discrimination (8.75), sexual bias (8.62), and sexual harassment (8.63) could occur (Table 5).

Table 3

Mean Score and Standard Deviation on Selected Female Teachers Leadership and Job Competencies as Perceived by Male Vocational Agriculture Teachers (n = 238)

Competencies	$\bar{x}$*	SD
Leadership		
Qualified females are competent to hold officer positions	9.53	1.23
Female teachers make strong leaders	6.31	2.62
Job		
Female teachers have good classroom management	6.14	2.40
Female teachers provide good classroom instruction	7.08	2.37
Female teachers handle shop classes well	5.53	2.61
Overall mean score	7.36	2.13

*Based on scale 1 = strongly disagree that female vocational agriculture teachers are competent.
10 = strongly agree that female vocational agriculture teachers are competent.

Table 4

Mean Score and Standard Deviation on Perceptions of Male Vocational Agriculture Teachers Regarding Taxonomies Female Vocational Agriculture Teachers are Competent to Teach
(n = 237)

Taxonomy	$\bar{x}$*	SD
Horticulture	9.38	1.21
Animal Care	9.21	1.49
Food Processing	9.20	1.49
Ag Business	9.10	1.58
Natural Resources	8.94	1.73
FBPA	8.50	2.12
Production Agriculture	7.76	1.79
Ag Mechanics	6.33	2.84

Note: 1 missing case
*Based on scale 1 = strongly disagree that female vocational agriculture teachers are competent to teach.
10 = strongly agree that female vocational agriculture teachers are competent to teach.

Male agriculture teachers perceive that sexual discrimination, sexual bias, and sexual harassment against female agriculture teachers occurred by selected groups and was evident in the reported mean scores (Table 6).

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. Perceptions of sexual discrimination, sexual bias, and sexual harassment were evident.

2. Perceptions of sexual discrimination against female teachers of agriculture was evident and brought upon by male teachers of agriculture and the agricultural community.

3. Results suggest that perceptions of sexual bias occured against female teachers by male agriculture teachers, students, parents, the agricultural community, and employers.

4. The data indicated that perceptions of sexual harassment occured against female teachers by students and parents of agriculture students.

5. Of sexual discrimination, sexual bias, and sexual harassment, sexual bias was the most problematic.

6. Female teachers were not being nominated proportionately to male teachers for leadership positions at the district and state level of the professional organization.

7. A very low percentage of male teachers have actually voted for female teachers for leadership positions within the professional organization.

8. Female teachers are viewed as being able to fulfill leadership roles. The three most commonly selected officer positions by male teachers for female teachers were Secretary, Treasurer, and Vice-President.

9. Male teachers perceived female teachers as being competent to teach agricultural subject matter.

Table 5

Mean Score and Standard Deviation on Male Vocational Agriculture Teachers Understanding of Meaning and Context Use of Sexual Discrimination, Sexual Bias, and Sexual Harassment
(n = 238)

	Sexual Discrimination		Sexual Bias		Sexual Harassment	
	$\bar{x}$*	SD	$\bar{x}$*	SD	$\bar{x}$*	SD
I understand the meaning of ____	9.34	1.49	8.98	1.74	9.23	1.70
I am familiar with the context of ____	8.75	1.98	8.62	2.06	8.63	1.99

*Based on scale 1 = strongly disagree with understanding and context of ____.
10 = strongly agree with understanding and context of ____.

Table 6

Mean Score and Standard Deviation on Male Vocational Agriculture Teachers Perceptions of Sexual Discrimination, Sexual Bias, and Sexual Harassment Against Female Vocational Agriculture Teachers by Selected Groups
(n = 236)

	Extent Against Female Vocational Agriculture Teachers					
Selected Groups	Sexual Discrimination		Sexual Bias		Sexual Harassment	
	$\bar{x}$*	SD	$\bar{x}$*	SD	$\bar{x}$*	SD
Male teachers of agriculture	6.53	3.12	5.46	3.27	4.12	2.56
Agricultural students	5.49	2.65	5.76	2.58	5.75	2.69
Parents of agriculture students	5.44	2.59	5.66	2.57	5.50	2.72
Agricultural community	5.56	2.65	5.71	2.65	5.42	2.65
Employers of agriculture students	5.28	2.55	5.53	2.57	4.90	2.53
School administrators	5.10	2.74	5.35	2.70	4.78	2.65

Note: 2 missing cases
*Based on Scale 1 = strongly disagree that ____ against female vocational agriculture teachers occurs.
10 strongly agree that ____ against female vocational agriculture teachers occurs.

Recommendations

1. In-Service education in the area of sex equity must be a priority of the state department of education staff.

2. Teacher education units must incorporate sex equity education into the pre-service program.

3. The professional organization must become more inclusive of female members at all levels in all its activities.

4. Strategies must be established to further enhance the female representation at the district and state level within the professional organization.

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